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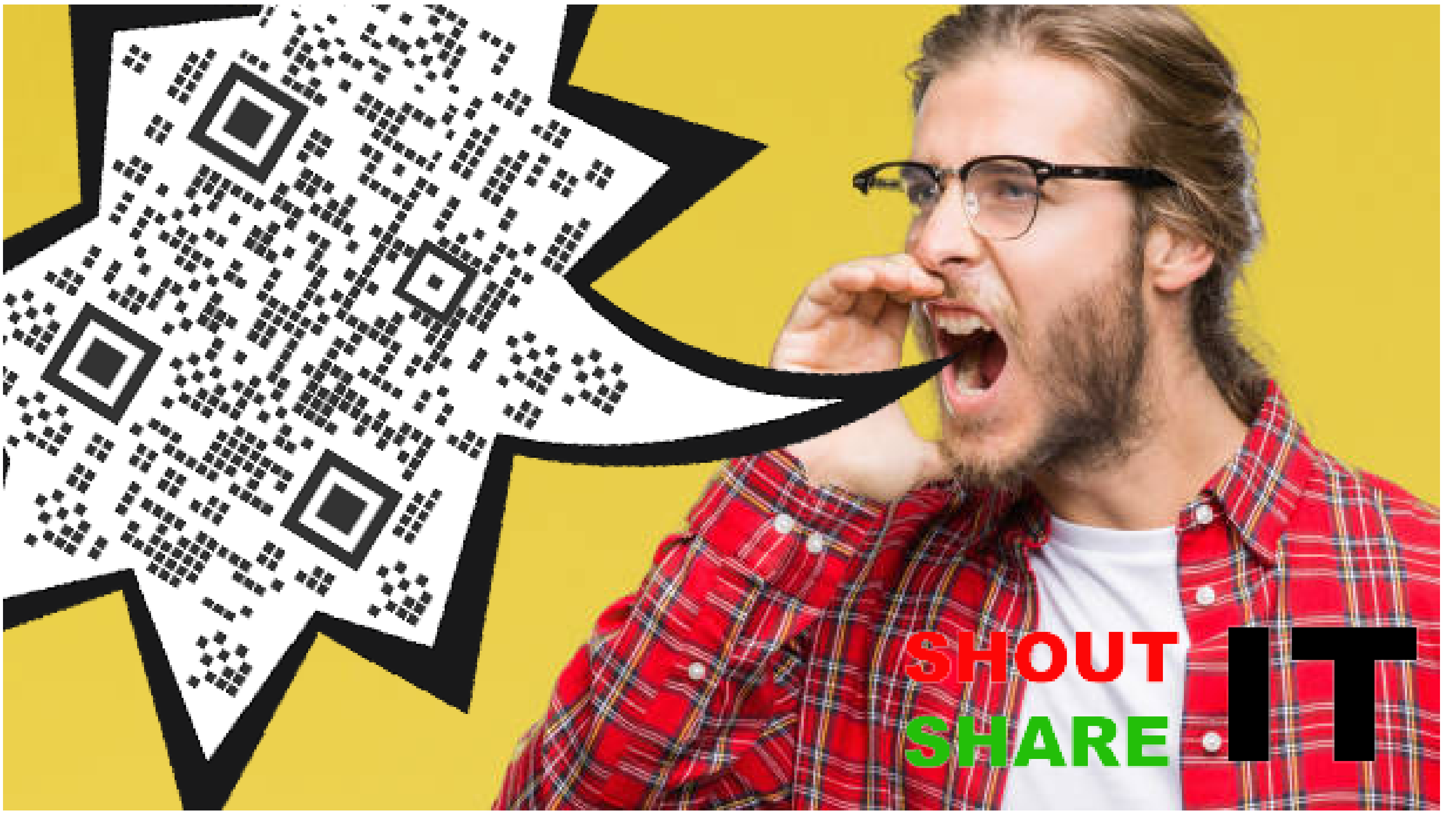
Field Museum of Natural History Bulletin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Field Museum of Natural History Bulletin

January, 1977
Vol. 48, No. 1

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CONTENTS

3 **Our Environment**

9 **Elephants and the Art of Taxidermy**

10 **The Eyes Have It**
The Remarkable Vision of Birds
By Eugene R. Slatick

12 **What's the Weight, by the Way, of a Quarter-Trillion Locusts?**

15 **Fieldiana**
Title and Price List for 1975 and 1976

16 **Books**
Melvin Traylor, curator of birds, reviews new work on the birds of Nepal

17 **Index to Field Museum of Natural History Bulletin, Vol. 47**

19 **A Major Operation**
by Berthold Laufer, late curator of anthropology

back cover **January at Field Museum**
Calendar of Coming Events

COVER

American bittern (*Botaurus lentiginosus*), wading bird common over much of North America. Its eyes are positioned low on the side of the head, so that when it points its head upward to blend with the reeds, it can still see what is happening in front. Photo courtesy Canadian Government Office of Tourism. For more on bird vision see p. 10.

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Our Environment

Grizzly bear diorama, Hall 16

Grizzly Critical Habitat

Approximately 20,000 square miles in Idaho, Washington, Montana, and Wyoming have been proposed for listing as critical habitat for the grizzly bear, a threatened species, the Fish and Wildlife Service announced recently in the *Federal Register*.

The proposed areas actually merge to form four zones of about 13 million acres. These are located in:

- The region where Wyoming, Montana, and Idaho come together, in Yellowstone National Park and adjacent areas, including parts of Custer, Shoshone, Teton, Targhee, Beaverhead, and Gallatin national forests, and part of Grand Teton National Park.
- Northwestern Montana, in Glacier National Park, the Bob Marshall Wilderness Area, most of the Flathead National Forest, and adjacent areas, including parts of the Lewis and Clark, Helena, and Lolo national forests, and small parts of the Blackfeet and Flathead Indian reservations.
- Extreme northwestern Montana and northern Idaho, in the Cabinet Mountains, mostly in the Kootanai, Kaniksu, and Lolo National forests; and
- Extreme northern Idaho and northeastern Washington, mostly in the Kaniksu National Forest.

These areas coincide approximately with the present regular distribution of the grizzly bear in the 48 contiguous states, and are the only remnants of the original range of the species which once covered a region approximately 50 times as great, from Canada to Mexico, and from the

Great Plains to the Pacific. These areas contain the only significant grizzly populations south of Canada, and, insofar as is known, provide all biological, physical, and behavioral requirements of those populations. Among the important characteristics of these areas is their relative inaccessibility and lack of the kinds of human developments and activities that tend to result in conflicts between the bears and man. This degree of isolation and freedom from excessive human presence seems critical to the survival of the grizzly. It is true that there are many natural or manmade sites scattered over these areas that are seldom or never utilized by the grizzly bear. It would not be possible, however, to attempt to identify all of these sites and exclude them from the overall designation.

There has been widespread and erroneous belief that a critical habitat designation is something akin to establishment of a wilderness area or wildlife refuge, and automatically closes an area to most human uses. Actually, a critical habitat designation applies only to federal agencies. It is essentially an official notification to the agencies that the Endangered Species Act requires them to ensure that their activities in a critical habitat area do not jeopardize endangered or threatened species or result in the destruction or modification of the habitat.

Public comments on the proposal may be sent through February 9, to the Director, U.S. Fish and Wildlife Service, Washington, D.C. 20240.

Annual Seal Slaughter

A massive killing of 23,110 fur seals occurred last summer on United States government land. From June 28 to the end of July, up to 1,000 seals a day were slaughtered under the auspices of the National Marine Fisheries Service of the U.S. Department of Commerce.

These killings were legalized by the Fur Seal Act of 1966, which has provisions calling for the United States to kill the marine mammals on their breeding grounds, the Pribilof Islands, situated in the Bering Sea 800 miles southwest of Alaska.

The basis of the Fur Seal Act was an attempt to stop other nations from killing the animals at sea. As a consequence, 15 percent of the U.S. kill goes to Canada and 15 percent to Japan.

The purpose of the annual slaughter is to save the herd; but the result has been to reduce the total fur seal population from an official figure of five million fur seals before the passage of the act to 1.2 million in 1976, as reported by the federal government.

In spite of the rapidly dwindling herd, Mark Keyes, Seattle veterinarian on duty during the slaughter, reported that plans had been made to start in 1977 the slaughter of two- to four-year-old female seals as well as males.

In 1976 the intent was to kill only bachelor male seals, but this is difficult because sexually immature seals of both sexes gather on the same hauling grounds from which they are driven inland for the kill. The kill is done by beating the seals with clubs.

Each fur skin is removed from the seal's body and shipped to Greenville, South Carolina, where it is commercially processed and sold at auction. A single firm holds a processing contract with the federal government. The carcasses are sold (also under contract) to an association of fur-breeders and recycled as food for ranch-raised mink.

The kill takes place in the name of conservation. By keeping the number of seals down, government biologists claim, the seals can thrive. In reality, say opponents, the Pribilof seal herds are thus threatened with annihilation. According to the Committee for Humane Legislation, headquartered in New York City, the number killed is diminishing even though every available seal is herded inland to the killing fields. The number killed in 1976 — 23,110 — is less than one-quarter the number of skins promised the furriers by the biologists. In 1972 testimony to the Congress concerning marine mammals, official data indicated that the federal management of seals would result in an annual kill of 100,000 seals.

The projected off-shore drilling for oil near seal breeding grounds is also cited by the Committee for Humane Legislation as a serious threat to the animals' survival. Oil slicks and nets, they contend, are extremely hazardous to seals.

Bird Repellent Developed for Use on Fruit Crops

U.S. Fish and Wildlife Service researchers have developed a bird repellent for use on sweet cherry crops that allows growers to raise cherries successfully and still have birds in their orchards. If its use is registered with the Environmental Protection Agency—and scientists think it will be—it would be the first time a chemical has been approved for protection of fruit from bird damage. Its use on other crops also looks promising.

The chemical, methiocarb, is a short-lived carbamate that breaks down rapidly in sunlight. The compound is a potent emetic, and when birds eat a few cherries they soon learn to associate its taste with its effects. The effect is temporary, however, and birds recover completely. In 10 years of field-testing at practical repellent-use levels, no birds have been found whose death was attributed to methiocarb. No chronic effects have been observed and reproduction is normal. The treatment appears to work on every major species of bird which attacks orchards.

Nationwide, more than $70 million worth of sweet cherries are grown annually and orchards are easy targets for birds which can and do inflict considerable damage on the ripening fruit. Damage in some orchards is now kept in food crops. Experiments conducted by FWS biologists over the last several years led to a registration of methiocarb in 1976 for use as a corn seed protectant against blackbirds. In many Eastern and Midwestern states blackbirds cause heavy damage to newly planted cornfields by eating the seeds shortly after they sprout. Methiocarb seems to be an effective solution to this problem, too. Methiocarb was also registered for use in 1976 as an insecticide on cherry and peach crops with a distinctly high permissible residue tolerance of 25 parts per million on cherries and 15 parts per million on peaches. Methiocarb also looks promising as a bird repellent on blueberries, grapes, grain sorghum, and sprouting rice.

Critical Habitat for Four Endangered Species

The critical habitat, or living space animals need to survive, has been officially listed for four endangered species—the American crocodile (*Crocodylus acutus*), California condor (*Gymnogyps californianus*), Indiana bat (*Myotis sodalis*), and Florida manatee (*Trichechus manatus*).

The Fish and Wildlife Service published a final rulemaking September 21 listing the areas which ought to remain unruined if the species are to have a decent chance to be saved. The rule went into effect October 22. It is by no means a guarantee, however, that man will be prevented from destroying the species.

Critical habitat for these four species, as well as for the snail darter (*Percina tanasi*) and the whooping crane (*Grus americana*), was proposed on Dec. 16, 1975. A final rulemaking designating critical habitat for the snail darter was issued on April 1, 1976. As for the whooping crane, so much information was received in response to the December 16 proposal that more time will be required for evaluation.

This determination is being made in accordance with Section 7 of the Endangered Species Act of 1973, which requires all federal agencies to ensure that actions authorized, funded, or carried out by them do not adversely affect the critical habitat of endangered and threatened species. The specific delineations of critical habitat in this rulemaking will assist federal agencies in knowing the areas where their responsibilities may apply. The designations, however, are not comparable to establishment of wilderness areas or wildlife refuges. No legal jurisdiction is assumed, and no prohibition of particular activity is made. The only specific effect of the rulemaking is that federal agencies will have to evaluate their actions with regard to the requirements of Section 7. The Fish and Wildlife Service emphasizes that the determinations apply only to federal agencies and only to their actions that may adversely affect the species involved. It is thought that many kinds of actions in the designated areas would not be detrimental.

The critical habitat being designated for the **American crocodile** covers the area inhabited by nearly all of these huge reptiles that survive in the United States. The area is located in extreme southern Florida, mostly in Everglades National Park and the northern Florida Keys. The 200 to 300 crocodiles here are dependent upon the waters of Florida Bay and the associated marshes, swamps, creeks, and canals. All known breeding females, of which there are less than 10 in Florida, inhabit and nest in the delineated area. ➤

Manatee diorama, Hall N

The **California condor**, of which only about 60 survive, is among the two or three most critically endangered birds in the United States. Ten separate parts of its remaining range in southern California are being recognized as critical habitat. The largest of these, the Sespe-Piru Condor Area in Los Padres National Forest, covers about 250 square miles of territory used by the species for nesting and related year-round activity. Six smaller blocks of land, totaling about 135 square miles also mainly in Los Padres National Forest, are utilized for nesting or roosting. Three larger areas, covering about 540 square miles, are located on rangelands to the north, and are where the condor searches for the carrion on which it feeds.

The Indiana bat, though numbering several hundred thousand, is endangered because it is losing the relatively few special kinds of caves in which it concentrates during the winter. Thirteen of these caves, located in Illinois, Indiana, Kentucky, Missouri, Tennessee, and West Virginia, are being designated as critical habitat. It is anticipated that additional caves, and possibly other parts of the bat habitat, will also be designated in the near future.

There are 600 to 1,000 **manatees** in the United States, the major concentrations being in Florida. Certain water areas are now known to be of particular importance, and these are being designated critical habitat. They include the Crystal River in Citrus County; portions of the Little Manatee, Manatee, Myakka, Peace, and Caloosahatchee rivers and Charlotte Harbor in west-central Florida; waters along the coasts of Lee, Collier, and Monroe counties; sounds along the southern tip of Florida; Biscayne Bay and adjoining waterways near Miami; Lake Worth, and the Loxahatchee, Indian, and Banana rivers, and portions of the Intracoastal Waterway along the east coast; and the St. Johns River.

Biologists who set out to determine what constitutes a critical habitat use these guidelines: (1) space for normal growth, movements, or territorial behavior; (2) nutritional requirements, such as food, water, minerals; (3) sites for breeding, reproduction, or rearing of offspring; (4) cover or shelter; or (5) other biological, physical, or behavioral requirements.

California condor

Shark Repellent that Works?

"The first known chemical that can prevent a shark from biting," is the way Eugenie Clark, director of the Cape Haze (Fla.) Marine Biological Laboratory, describes "Albro," an extract from dorsal and anal fin glands of the Moses sole (*Pardachirus marmoratus*).

Clark and co-workers discovered that the sole, native to the Red Sea, secretes a milky substance that can kill small marine animals and stun sharks and barracuda, causing temporary paralysis. The toxin destroys red blood cells. Remarkably, the Moses sole is valued by Red Sea coastal peoples as a food fish; the poison is destroyed by cooking.

A component of the sole's milky secretion was observed to have an inhibiting effect on the toxin and is thought to protect the sole from its own poison. The inhibitor also counteracts the toxic effects of venom from bees and scorpions as well as from cobras, mambas, and coral snakes. Plans are underway to make the shark repellent commercially available.

EPA Cancels Mirex

The Environmental Protection Agency announced on October 20 the cancellation of current registrations of the pesticide Mirex. Mirex, a persistant chlorinated hydrocarbon like DDT, has been used since 1962 to control fire ants throughout the South. In announcing his decision, EPA Administrator Russell Train said that the cancellation "concludes one of the longest and most difficult chapters in environmental history."

The state of Mississippi, which owns the only Mirex 4X fire ant bait formulating plant currently in operation, offered a plan last fall to voluntarily cancel the registration of Mirex after EPA discovered residues of the pesticide in human tissue samples taken in the South. Mirex has caused cancer in laboratory animals, and, according to Train, is considered a human carcinogen. It is also known to be toxic to several forms of nontarget organisms, especially those in the aquatic environment.

The cancellation plan would permit aerial application of a diluted formulation until Dec. 31, 1977. Ground application could continue until June 30, 1978. However, Hooker Chemical Company, which produces technical Mirex, refuses to sell this concentrated form of the chemical to Mississippi unless the state promises complete indemnification, thus protecting Hooker against financial losses from possible lawsuits.

National Parks Declining?

National park facilities and services are deteriorating because of inadequate funding and lack of employees, according to a report released recently by the House Committee on Government Operations. The report, entitled "The Degradation of Our National Parks," outlines the findings and recommendations which are the result of an extensive investigation conducted by the Conservation, Energy, and Natural Resources Subcommittee.

The report charges that "The Park Service's resources are now, and have for the last several years been, inadequate to carry out the tasks which the NPS is mandated to perform. The guardian of our National Parks has, despite its best efforts, seen its resources deteriorate . . . park buildings, roads, bridges, trails, historic sites, and archaeological relics are not being maintained according to the Park Service's own standards."

Subcommittee Chairman Leo J. Ryan (Cal.) stated that "This report well documents the sad state of conditions presently existing in our national parks. It's about time the Interior Department, the OMB, and the Congress respond to the obvious need for additional resources of one of our most dedicated and responsible federal agencies — the National Park Service."

California Falcon Program Successful

For the first time in California, young prairie falcons bred in captivity have been introduced successfully into the wild. The breakthrough occurred last year when Gary Beeman, a falconer operating under a permit from the state, produced 10 young prairie falcons. This year 12 young were raised and two were placed in a nest of wild prairie falcons in northern California. They were adopted and fed by their foster parents and are now foraging for themselves.

Beeman noted that even under the best of conditions a pair of prairie falcons in the wild would require a minimum of eight years to produce 22 young, the number he brought off in two years. Techniques used in Beeman's captive raptor breeding program will be used to supplement wild populations of the endangered peregrine falcon in California. ☐

Diorama of Illinois woodland, Hall 29

Certified Wildflower Varieties to Become Available

Certified varieties of native wildflowers are being released after ten years of cooperative tests by the U.S. Soil Conservation Service (SCS), the Kansas and Nebraska state agricultural experiment stations, and the Nebraska Department of Roads.

The plants, according to SCS, control erosion, are beautiful, and provide wildlife food and cover. The newly domesticated wildflowers include purple prairie clover, pitcher sage, and thickspike gayfeather. Authorities expect the plants to be used initially to beautify and stabilize road rights-of-way.

SCS' Plant Materials Center at Manhattan, Kansas, will produce and distribute foundation seed to selected seed growers this fall. Assuming a good growing season, there should be limited quantities available by the fall of 1978.

Pollution Control-Environmental Conference

A "how-to" session on putting profits on the black instead of the red side of the ledger when dealing with pollution cleanup is to be held in Chicago at a high-level industry and government conference January 17 and 18. The meeting place is the Hyatt Regency O'Hare.

The conference, titled "Beyond Environmental Regulations: Industry Takes the Initiatives," is cosponsored by the midwest EPA office, the U.S. Department of Commerce, state chambers of commerce and manufacturers' associations in Illinois, Indiana, Michigan, Wisconsin, Ohio, and Minnesota. Corporations cosponsoring the conference include Commonwealth Edison, Eli Lilly, Dow Chemical, Hydroscience, Republic Steel, 3M, and St. Regis Paper Company.

The first day of the conference will zero in on achievements by corporations who have made process changes that save money, conserve resources, and reduced pollution. The day's agenda will be geared towards corporate decision makers. The second day will cover specific technical approaches of midwest companies in process changes and will be aimed at environmental managers.

Bald Eagles and Ospreys Recovering in Lake States

Bald eagles and ospreys are doing well on national forests in the Lake states, according to the Wildlife Management Institute. A 1976 survey by the U.S. Forest Service shows that eagle numbers "are holding up well and may even be increasing." The osprey had its best reproductive season since at least 1962. Biologists located 249 osprey nests this year compared to 238 in 1975. At least 120 young were fledged, the highest number ever recorded for the area.

This year researchers located 414 bald eagle nests. That is 16 more than last year. Those nests produced a minimum of 187 young, a few more than were noted in 1975. All things considered, biologists are encouraged by the continued improvement in eagle and osprey populations in the region.

'Wolves' Frighten Northern Minnesota Residents

The following report, taken from the November 11 Tower News, *published in the northern Minnesota village of Tower, recounts the frightening experiences of local residents, presumably with wolves:*

"The menacing presence of wolves in the vicinity of communities and farms has now become a reality in Tower-Soudan. While many people previously had regarded stories of wolf kills with indifference and had questioned the credibility of the accounts, an incident during the past week has changed the opinions of many local residents.

"At dusk last Thursday, as John Pahula was returning to his home in Soudan, after having spent the day at his cabin on Armstrong Bay of Lake Vermilion, he sighted two wolves approaching him just off the right-hand side of the trail. Almost simultaneously, he caught a glimpse of another wolf on a hill to his left.

"John was accompanied by his constant companion, his little Pedro. While Pedro wasn't a tiny dog, he was described as just a little smaller than a medium size dog. Ordinarily, Pedro was inclined to rush to his master for protection and guidance in unusual circumstances, but on this occasion he apparently felt that he had to protect the life of his master. He rushed off in pursuit of the two wolves while the third wolf sped down the hill, across the trail and off into the woods after the dog. Mr. Pahula heard one loud yelp, followed by an ominous silence. He called in vain for his dog, and then hurried back to [the nearby home of a friend] relate the story and enlist his assistance.

"Darkness prevented a search of the nearby woods that evening, but Mr. Pahula [and his friend] went out Friday morning to look for Pedro, although both men felt that they already knew it was hopeless. They soon found the spot where little Pedro had been attacked and killed. They tracked the trail where the wolves had dragged their prey, and they ended their search on a heartbreaking scene, a tiny hank of hair, three small bones and Pedro's collar.

"While Mr. Pahula will never really know, he feels that Pedro's pursuit of the wolves was a valiant effort to protect his master, and believes that Pedro sacrificed his life for him.

"A number of people in the area have reported having seen wolves in the vicinity of Soudan and along the highway, although none of them have had the tragic experience of Mr. Pahula. Those who have sighted the animals feel that citizens should be warned of the dangers involved in walking in the woods or working in the woods without some means of protection. However, residents are reminded that it is illegal to kill a wolf, since they are protected.

"Mr. and Mrs. John Spollar had what Mrs. Spollar described as 'a most terrifying experience' in September, when they encountered a pack of at least five wolves during one of their daily walks on the Six-Mile Lake Road. As they rounded a curve in the road, Mrs. Spollar spotted some animals on top of an adjacent hill. Before realizing that they were wolves, the thought crossed her mind that it was an odd place for a herd of cattle. One of the animals raised its head, and she noted the similarity between the animal and a German Shepherd dog which the couple used to have. In that split second, she realized that she was facing wolves.

"She shouted, 'Wolf,' to her husband, whose vision of the scene was blocked by the brush around the curve. He picked up a rock and threw it at the creatures, who were all standing with their heads raised. The couple had no means of protection, not even a pocket knife or matches, and they fled. 'We ran as fast as we could,' related Mrs. Spollar. 'My heart was pounding so, I thought I'd have a heart attack. When I saw the look of fear on John's face, I was even more terrified, if that were possible.'

"The fact that the animals stood their ground and seemed to have no fear of the two humans caused them further consternation. Mrs. Spollar began shouting as she ran, in an effort to frighten the animals. When asked if the wolves chased them or followed them, she replied that they never did look back, and never did ascertain if there were more than five wolves or if the animals had chased them at all.

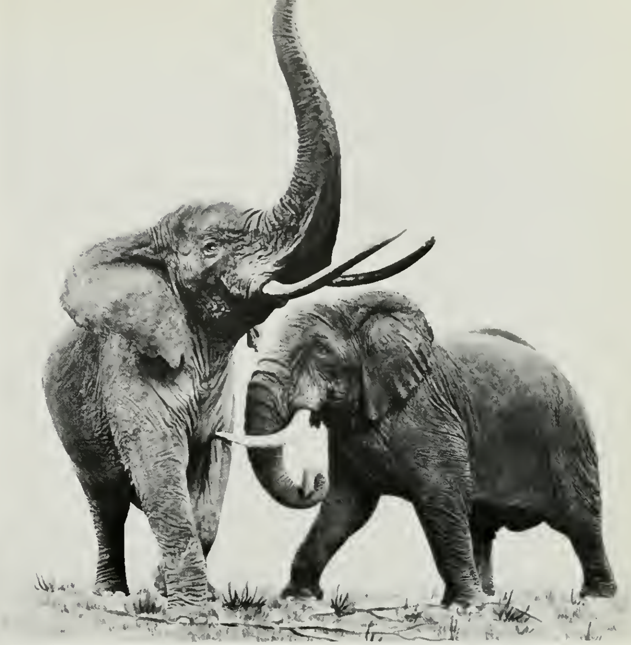
"Traveling to Ely several weeks later, the couple spotted a lone wolf along the highway, and they and the occupants of a truck stopped to watch the animal, which showed no signs of fear.

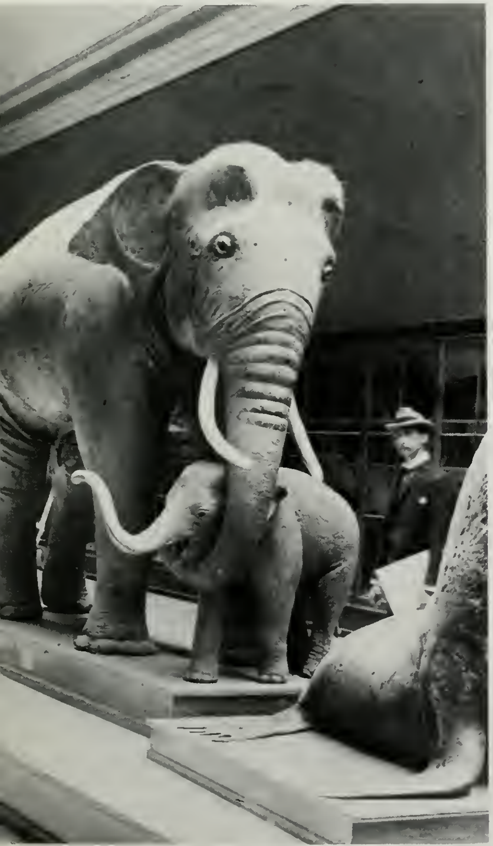
"The Spollars still enjoy their daily walks, but they are now confining their travels to more heavily traveled roads."

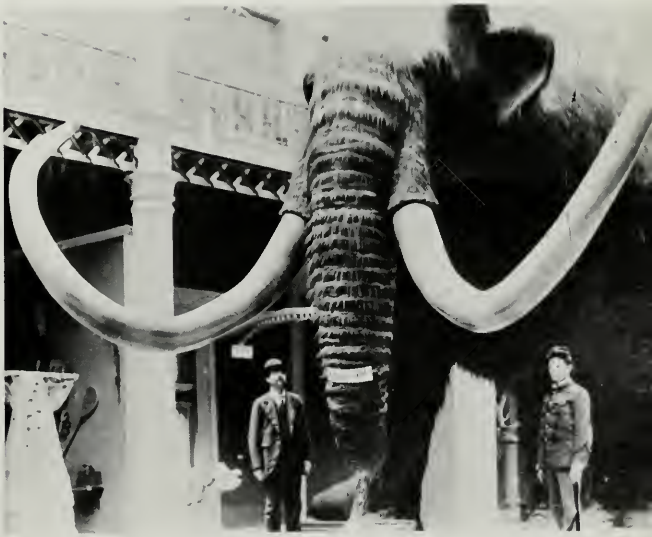
Elephants and the Art of Taxidermy

A brief span of time—perhaps fifteen years at most—separate the Dumbolike representation of Indian elephants below and the stunning lifelike African elephants at the right. The Indian elephants and the mammoth, lower right, were on view in the 1890s at Field Museum's first quarters—the building which had served as the Palace of Fine Arts, in Jackson Park, during the World's Columbian Exposition. (At its founding in 1893 the museum was named "The Columbian Museum of Chicago"; the following year the name was changed to "Field Columbian Museum." Shortly before the death of founder Marshall Field in 1906, the name was again changed to "Field Museum of Natural History.")

The pair of African elephants at right were acquired by then chief taxidermist Carl Akeley during a 14-month expedition to Africa in 1905-06. They may still be seen, of course, in Stanley Field Hall, every bit as impressive and lifelike as when mounted 70 years ago. (The foreground in this photo has been added by a retouch artist.) The Indian elephants and the mammoth were disposed of before the museum moved to its present building in Grant park in 1921.







The Eyes Have It

The Remarkable Vision of Birds

By Eugene R. Slatick

Most of us know from experience that birds have sharp eyesight. Perhaps we found this out trying to sneak up on a crow, only to have it fly away before we got close. Maybe we realized it when we watched a barn swallow catch insects on the wing, or a hawk swoop down on a field mouse, or a ruffed grouse fly unerringly through thick woods. Such things tell us that there is little that escapes a bird's eye. Birds need to see well if they are to survive.

The eyes of a bird are very large compared to the size of its body. We may not realize this because the lid-opening of the bird's eye is often small. The eyes of some hawks and owls are about the same size as our eyes. In fact, the eyes of birds take up so much that they leave little room for eye muscles. A bird can move its eyes only a little, at best. An owl can't move its eyes at all because they fit so snugly. But the lack of eye movement doesn't create any problems. Most birds have eyes on the side of their heads which take in a wide view at a glance. Even those birds with eyes in the front of their heads, like hawks and owls, can still get a wide view by turning their heads on flexible necks. Sometimes an owl seems to twist its head completely around, but it cannot quite accomplish this. The owl turns its head almost 270° in one direction, and then quickly flicks it around to the other side to continue surveillance.

Like our eye, a bird's eye has a lens that can be focused, an iris that controls the amount of light that enters, and a retina that records scenes and transmits them to the brain. But the bird's eye has several features that make it something special — they illustrate how nature perfects a basic design to improve an animal's change of survival.

For example, when seen in cross section, the shape of the eye of most birds is a little flatter than our eye. That type of eye gives a wide view. Birds that need very keen vision, like hawks, have an eye in which the lens area protrudes. This gives a narrower field but a larger image of distant objects, and the bird can see more details — just like a telephoto lens on a camera reveals distant scenes more clearly. The huge, bulging eye of an owl is still another variation. It is designed to collect a lot of light, like a "fast" photographic lens.

But eye shape isn't all that makes a bird's vision special. The retina of a bird's eye has many more light-sensitive cells than a human's retina. These very tiny cells are the rods and cones. The rods are sensitive to very dim light but not to color, while the cones respond to brighter light and give sharp detail and color vision. The avian eye may be equipped with a million cones per square millimeter — 7 times more than our eyes contain. No wonder a falcon is said to be able to spot a pigeon at 3,500 feet when the lighting is right. Sparrow hawks are said to have vision 8 times sharper than ours. The vision of the buteo hawks may not be quite as good as this, but their eyes are still about 5 times sharper than ours.

Many of the cones in a bird's eye contain tiny drops of colored oil that help sharpen the image, just like photographic filters help improve some pictures. The drops are generally yellow, but some may be red, orange, and green. In nocturnal birds they are pale yellow or colorless. The yellow drops help offset haze. Red drops probably give contrast to certain objects and improve vision when looking into water. About 20 percent of the droplets in songbirds, ducks, and herons are red, whereas the total is less in hawks and swallows. The kingfisher reportedly has the most—up to 60 percent.

Birds that are active during the day have more cones than rods in their eyes. This gives them sharp, colored vision during the day, but comparatively poor sight quality in dim light or at night. Birds of the night, like owls, have more rods than cones, enabling them to see very well at night; during the day, however, they don't see in great detail and probably not in much color. The difference in quality might be comparable to that of a sharp color photograph that is reproduced in black and white in a newspaper. The newspaper print gives a clear enough picture, but it lacks the fine detail of the photograph. We can see surprisingly well on a moonlit night, but imagine how well an owl must see at night — its night vision is 50 times better than ours.

Almost all birds have at least one place on the retina that gives the sharpest vision. Such a place, called the fovea, is surrounded by a region named the central area, which gives a picture almost as sharp. Many birds that hunt or feed on the wing, like hawks and swallows, need to judge distances accurately, so they have two foveae. One generally sees straight ahead while the other scans below. Many birds of the open fields and shores — hawks, ducks, shorebirds — have a central area that extends horizontally across the eye. It enables those birds to see the horizon and landscape in good detail without constantly turning the head.

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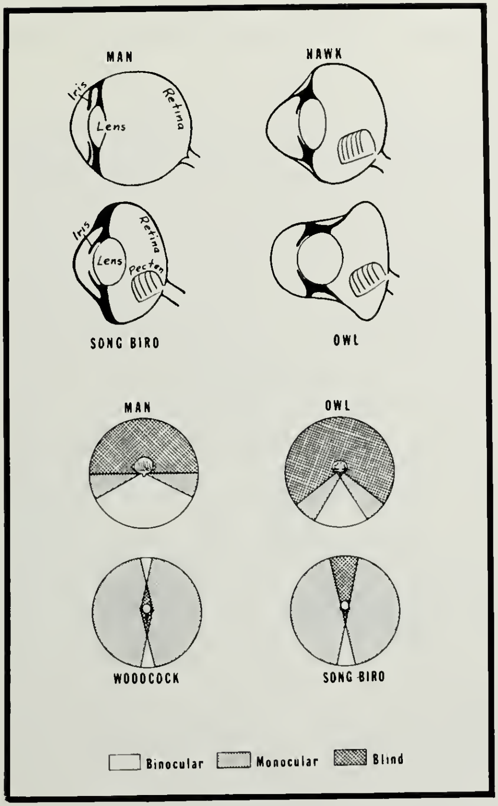


Sometimes we see a bird cock its head in an unusual position and think it is listening for something. A robin does this while hunting worms. But the bird isn't listening for the worms; it is looking for them, shifting its head so it can examine the ground with the sharpest part of its eye.

A bird's eye has a puzzling feature called the pecten, a folded, tissue-like membrane of blood vessels that protrudes into the eye. It is large in predatory birds and smaller in other birds. The pecten probably is a device that assures the eye of sufficient nutrients and oxygen, although scientists have suggested many other purposes.

Birds have been called "glorified reptiles," because they can be traced back millions of years to reptilian ancestors. One of the clues to this lineage is the pecten, also possessed by reptiles. Another is the sclerotic ring, a ring of a dozen or more bony plates surrounding the cornea, present in both birds and reptiles. It helps the bird's eye keep its shape when the eye muscles adjust the lens for various distances. The sclerotic ring ranges from a simple circle in songbirds to a large prominent structure in owls.

You might have noticed that birds blink differently than we do. Most of them blink with a third eyelid, or nictitating membrane, attached to the part of the eye near the bill. The other lids are usually used only when sleeping. The third lid, usually semi-transparent, cleans the eye and protects it against strong glare and wind. Some diving birds are thought to use the third lid when underwater.

In making the bird a sharp-eyed animal, nature didn't limit itself just to physically improving the eye. It also positioned the eye in the head to perform a function. Most birds have eyes on the side of the head that can see almost all the way around. The eyes of such birds are generally flat—the shape that gives the widest field of view. This group of birds has a certain amount of binocular vision, which is the area that can be seen by both eyes. The familiar pigeon, for example, has a visual field of 340°, including a binocular field of 24°. Generally birds that catch insects while airborne have a binocular field larger than the field of birds that feed from the ground. Predatory birds have eyes facing forward so that both can be used to judge distances. Hawks have a binocular field of 35° to 50°, whereas in owls it is up to 70°. The total field of view of these birds is reduced consequently to about 250° for hawks and 110° for owls. Ornithologists are not certain if birds see in three dimensions, or stereoscopically, when they use binocular vision. A bird that does not have much binocular vision can judge the distance of an object by moving its head to get different views.

The bittern and woodcock have eyes in interesting positions. The eyes of the bittern are low on the side of the head, so that when it points its head upward to blend in with the reeds, the bittern can still see what is happening in front. The woodcock, on the other hand, has eyes set far back and high on the head, allowing it to see around while it probes the ground for food with its beak.

Although we know a lot about how a bird sees, we don't know just what it sees because its brain may receive the picture in a way different from ours. We can only imagine how a field mouse looks to a hawk high in the sky, or how an owl sees the landscape in the dark of night. It has been said that birds may not have sharper eyesight than we have but can assimilate what they see much faster and in more detail. One ornithologist made the analogy that a bird could tell whether a clock was operating simply by observing the movement of the hour hand, while we need to look at the minute hand.

A bird's eye also "sees" the time on the biological clock. It unconsciously records seasonal changes in the amount of light. The brain takes that and other stimuli into account, and directs the bird to migrate or mate.

Although our eyes are better than those of many animals, we find our match in the birds. As many outdoorsmen know, however, being "hawkeyed" or "eagle-eyed" is also a matter of training. Birds scrutinize the woods, fields and waters because it is a matter of survival for them. Perhaps with some practice we might learn to see a little more like a bird and maybe see new and interesting things in familiar scenes. ☐

What's the Weight, by the way, of a quarter-trillion locusts?

STRANGE YOU SHOULD ASK, because I just happened across that morsel of information while browsing through the *Guinness Book of World Records:* "about 500,000 tons," says Guinness. A swarm of this size, Guinness goes on, was observed flying over the Red Sea in 1889, and it covered an estimated 2,000 square miles—about the size of the state of Delaware. The weight of those insects would be equal to more than 1,200 fully loaded 747 jumbo jets.

And if locust swarms aren't your dish of tea, perhaps you'd be more impressed by the fact that the lowly ribbon worm *(Lineus longissimus)* has made it into the record books by virtue of its inordinate length. One specimen, washed ashore at St. Andrews, Fife, Scotland, in 1864 measured out to 180 feet, thus claiming the honored title "earth's longest worm." Even by Woolworth's standards that's a lot of ribbon.

The longest measurements for any type of animal were those of a giant jellyfish *(Cyanea arctica)* washed onto the Massachusetts coast in 1865. Its bell, or body, was 7½ feet in diameter and its tentacles measured 120 feet; thus, the total length with tentacles extended would have been about 245 feet.

And speaking of length, the world's longest snake was no slouch by any standards. That specimen was a 27½-foot anaconda *(Eunectes murinus)*, captured in Colombia in 1944. The longest snake in captivity was "Colossus," a female reticulated python *(Python reticulatus)* which measured 28 feet six inches in 1956. At that time the snake, kept in the Highland Park Zoological Gardens, Pittsburgh, was growing about 10 inches each year. She died in 1963. The longest crocodile known was a 27-foot salt-water, or estuarine, crocodile *(Crocodylus porosus)* killed in the Philippines in 1823. Its weight was 4,400 lbs, some of which had been gained by dining on local villagers. The longest of living lizards was a Komodo monitor *(Varanus komodoensis)*, which taped out at 10 feet 2 inches in 1937 when it was on display at the St. Louis Zoological Gardens. Its weight was 365 lbs.

The longest frog on record is a Goliath frog *(Rana goliath)* from west Africa, measuring 13.38 inches from snout to vent and 32.08 inches extended. It weighed 7 lbs., 4.5 oz. Perhaps the longest recorded frog leap—17 feet 4⅜ inches—is that of "Wet Bet," a frog which performed this feat at the 1973 Calaveras County (California) Jumping Frog Jubilee.

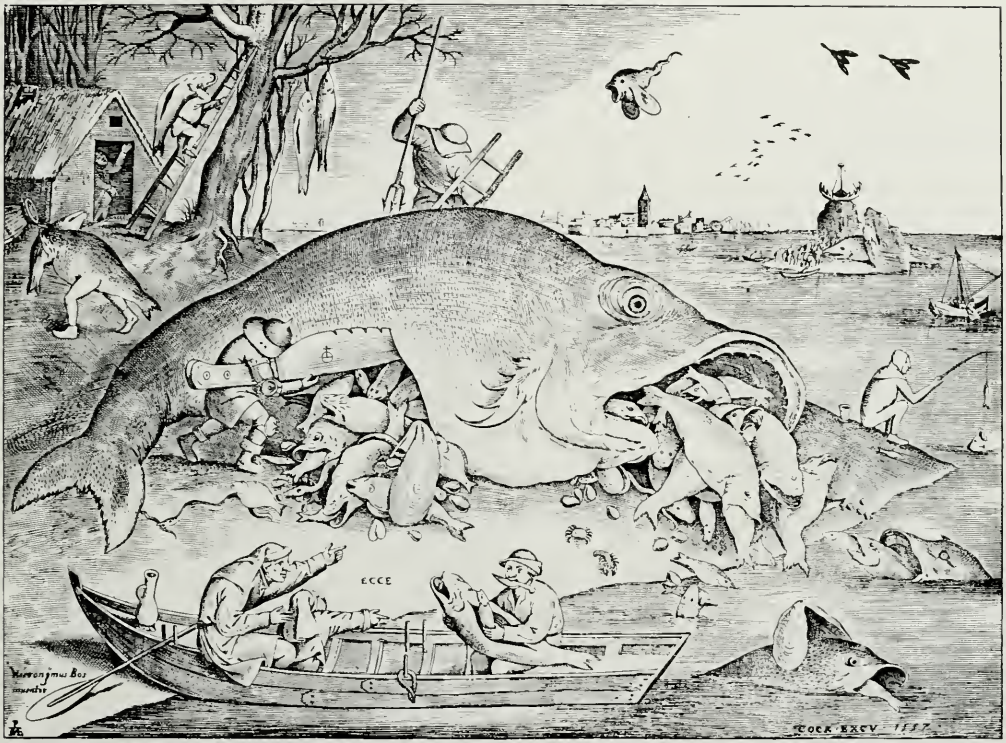
Length records among fishes include 59 feet for a 90,000-lb. whale shark *(Rhiniodon typus)* caught in the Gulf of Siam in 1919, 37 feet for a great white shark *(Carcharadon carcharias)* captured off New Brunswick in 1930, 26 feet 3 inches for a Russian sturgeon *(Acipenser huso)*, and 14 feet (between anal and dorsal fins) for an ocean sunfish *(Mola mola)*—the largest of the bony fishes—caught in Australian coastal waters in 1908; its weight was 4,928 lbs.

Among spiders, the giant is the bird-eating spider *(Theraphosa leblondi)* of South America. A 2-oz. male collected in French Guiana in 1925 had a 3½-inch body and a leg extension of 10 inches. A much larger, extinct relative was the 9-foot *Pterygotus buffaloensis,* a sea scorpion that lived some 400,000,000 years ago.

A claw span of 12 feet 1½ inches makes a 14-lb. specimen of the giant spider crab *(Macrocheira kaempferi)* the largest crab known; there are unconfirmed reports of 19-footers. The species occurs in deep waters off the coast of Japan. The heaviest of the true crab species is *Pseudocarcinus gigas* from the Bass Straits, off Australia; 30-lb. specimens are known. Lobsters—close cousins of the crab—are still heavier; the greatest authenticated weight is 42 lbs. 7 oz. for a North Atlantic lobster, *Homarus americanus,* caught off Virginia in 1934.

The longest insect known is the tropical stick insect *(Pharnacia serratipes)*, which measures about 13 inches. The birdwing butterfly *(Ornithoptera victoriae)* of the Solomon Islands is also known to exceed 12 inches in wingspread. The heaviest insect is equatorial Africa's Goliath beetle *(Goliathus goliathus)*, which has tipped the scales at 3.52 ounces. Among centipedes the longest species measured—*Scolopendra morsitans*—grows up to 13 inches long and comes from the Andaman Islands in the Bay of Bengal. The longest millipede species are *Graphidostreptus gigas* (Africa) and *Scaphistostrepus seychellarum* (Seychelle Islands), both measuring more than 11 inches long.

Size records among mollusks include 43 inches by 29 inches for a 579½-lb. clam *(Tridacna derasa)* found in 1917 on the Breat Barrier Reef; 55 feet for an Atlantic giant squid *(Architeuthis sp.)* washed ashore on Newfoundland in 1878 and estimated to weigh 4,480 lbs.; and 25 feet 7 inches—radial spread—for a 118-lb. 10-oz. octopus *(Octopus apollyon)* caught in Puget Sound in 1973.



This remarkable fish, fantasized by Dutch artist Hieronymus Bosch, would have garnered all sorts of records.

The largest accurately measured vertebrate animal was a female sulfur-bottomed, or blue, whale *(Balaenoptera musculus)*, caught in the South Atlantic in 1912. It measured 110 feet, 2½ inches. Another female of the species, caught in the same area in 1931, was calculated to weigh 183.34 tons, exclusive of blood, and its live weight estimated at about 195 tons.

The largest eye of any living animal is that of the giant squid *(Architeuthis sp.)*, exceeding 15 inches in diameter.

The largest land animal is the African elephant *(Loxodonta africana africana)*. The largest known specimen, shot in Angola in 1955, weighed about 24,000 lbs. Its standing height was about 12 feet, 6 inches. (The mounted carcass is now on view at the Smithsonian Institution.)

For those whose special pleasure is diminutives, what could be more gratifying than to know that the smallest land mammal is Savi's white-toothed pygmy shrew *(Suncus etruscus)*, full-grown specimens weighing between 0.062 and 0.09 oz. Mature ➤

individuals measure 1.32 to 2.04 inches, plus a tail length of 0.94-1.14 inches.

The fastest land animal, as any speed buff can tell you, is the cheetah *(Acinonyx jubatus)*. Zoologists estimate the cat's maximum speed at 60-63 m.p.h. Under controlled conditions on an oval track, a cheetah was clocked at 43.4 m.p.h. average speed for 1,035 yards, but the animal was not running at its top speed. The pronghorn antelope *(Antilocapra americana)*, nearly as fast as the cheetah, has been clocked at 61 m.p.h. over a 200-year distance.

The longest-lived land mammal, exclusive of man, is probably the Asiatic elephant *(Elephas maximus)*. The oldest known specimen is Modoc, a female who, at 78, was still alive and well at last report.

The largest known herds of any animal species are those of the South African springbok *(Antidorcas marsupialis)*. A herd viewed in 1888 in Cape Province, South Africa, was estimated to contain 100,000,000 individuals.

The longest known gestation period among mammals is that of the Asiatic elephant *(Elephas maximus)*, with a minimum period of 609 days and a maximum of 760 days.

The shortest gestation period may be that of the American opposum *(Didelphis marsupialis)*, which is normally 12 to 13 days, but sometimes as brief as 8 days.

Wing beats, too, have found their way into the record books. The fastest recorded wing beat of any bird is 90 beats per second—claimed by *Heliactin cornuta*, a tropical American hummingbird. Not to be outdone, a lowly midge (insect) of the genus *Forcipomyia* has moved its wings at the phenomenal rate of 1,406 beats per second! Butterflies, at the other end of the scale, manage to stay aloft with average wing beats for sustained flight as slow as 5 beats per second (*Papilio machaon*, a swallowtail).

But these achievements pale to mere exhibitionism when compared to utilitarian feats of the domestic cat and dog. In 1853, in Liverpool, England, a bull terrier by the name of "Jenny Lind" killed 500 rats in 90 minutes. A tabby cat by the name of "Minnie" is credited with 12,480 rat kills from 1927 to 1933 at the White City Stadium in London. Another Tabby, named "Mickey," killed more than 22,000 mice in Lancashire, England, over a 23-year period.

Specimens of the Goliath beetle, the heaviest known insect (3.52 oz.), are displayed by Rupert Wenzel, chairman of the Department of Zoology.

Note: Records cited above include only those considered authentic by Guinness. Their discussion here does not constitute validation or recognition by Field Museum.

Fieldiana: 1975 and 1976 Titles

Fieldiana is a continuing series of scientific papers and monographs in the disciplines of anthropology, botany, zoology, and geology; the series is intended primarily for exchange-distribution to museums, libraries, and universities, but all titles are also available for public purchase.

The following titles were published during 1975 and 1976 and may be ordered from the Division of Publications. Members are entitled to a 10 percent discount. Publication number should accompany order. A catalog of all available Fieldiana titles is available on request. (Please specify discipline: anthropology, botany, geology, or zoology.)

Fieldiana Anthropology

"Chapters in the Prehistory of Arizona," by Paul S. Martin, et al. Vol. 65, No. 2; publication 1201. $9.75

"Mrs. Kadiato Kamara: An Expert Dyer in Sierra Leone," by Loretta Reinhardt. Vol. 66, No. 2; publication 1230. $1.25

"Ethnological and Biogeographical Significance of Pottery Sherds from Nissan Island, Papua New Guinea," by Susan Kaplan. Vol. 66, No. 3; publication 1231. $2.25

"The Bruce Collection of Eskimo Material Culture from Port Clarence, Alaska," by James W. VanStone. Vol. 67; publication 1244. Price to be announced.

Fieldiana Botany

"Flora of Guatemala Rubiaceae, Madder Family," by Paul C. Standley and Louis O. Williams. Vol. 24, Part XI, Nos. 1-3; publication 1202. $8.75

"Austral Hepaticae III Stolonophora, A New Genus of Geocalycaceae," by John Engel and R. M. Schuster. Vol. 36, No. 11; publication 1208. $1.00

"Tropical American Plants, XVII," by Louis O. Williams. Vol. 36, No. 10; publication 1210. $1.50

"Notes on Calvatia (Lycoperdaceae), I," by Patricio Ponce De Leon. Vol. 38, No. 1; publication 1215. $.75

"A Partial Revision of 'Paullinia' Sapindaceae) for Ecuador, Peru, and Bolivia," Part I, by Donald R. Simpson. Vol. 36, No. 12; publication 1225. $1.50

"New Species of 'Digitaria, Pennisetum, and Poa' (Graminae) from Costa Rica," by Richard W. Pohl. Vol. 38, No. 2; publication 1228. $.75

"Flora of Guatemala—Vernonieae, Astereae, Inuleae, Heliantheae, Anthemideae, Cynareae, Mutiseae, Cichorieae, Eupatorieae, Helenieae, Senecioneae," by Dorothy L. Nash and Louis O. Williams. Vol. 24, Part XII; publication 1229. $18.00

"Notes on 'Calvatia' (Lycoperdaceae), II 'Calvatia cretacea' (Berk.) Lloyd, An Arctic Montane Plant," by Patricio Ponce De Leon. Vol. 38, No. 3; publication 1233. $.75

"Acutocapillitium, a New Genus in the Lycoperdaceae," by Patricio De Leon. Vol. 38, No. 4; publication 1237. $.75

"Flora of Guatemala," by Dorothy L. Nash. Vol. 24, No. 4; publication 1238. $5.25

Fieldiana Geology

"Pyritic Cone-In-Cone Concretions," by Bertram G. Woodland. Vol. 33, No. 7; publication 1200. $1.25

"Caryocrinitidae (Echinodermata: Rhombifera) of the Laurel Limestone of Southeastern Indiana," by T. J. Frest. Vol. 30, No. 4; publication 1203. $1.50

"The Mammalian Fauna of Warsasi Rock Shelter, West-Central Iran," by Priscilla F. Turnbull. Vol. 33, No. 8; publication 1204. $1.25

"Phylogeny of the Chelydrid Turtles: A Study of Shared Derived Characters in the Skull," by Eugene S. Gaffney. Vol. 33, No. 9; publication 1205. $1.50

"Time Factors of Differentially Preserved Wood in Two Calcitic Concretions; in Pennsylvanian Black Shale from Indiana," by Bertram G. Woodland. Vol. 33, No. 10; publication 1206. $1.25

"The Mammalian Fauna of Madura Cave Western Australia Part II," by William D. Turnbull and Ernest L. Lundelius, Jr. Vol. 31, No. 2; publication 1209. $2.75

"Geochronology, Stratigraphy, and Typology," by John Andrew Wilson. Vol. 33, No. 11; publication 1211. $1.00

"Phosphatic Microfossils from the Ordovician of the United States," by Matthew H. Nitecki, Raymond C. Gutschick, and John E. Repetski. Vol. 35, No. 1; publication 1214. $1.00

"A New Species of Globidens from South Dakota, and a Review of Globidentine Mosasaurs," by Dale A. Russell. Vol. 33, No. 13; publication 1217. $1.50

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"Ziphodont Crocodiles: Prisichamsus vorax (Troxell), New Combination from the Eocene of North America," by Wann Langston, Jr. Vol. 33, No. 16; publication 1222. $1.50

"Silurian Ischadites tenuis n. sp. (Receptaculitids) from Indiana," by Matthew H. Nitecki and Charles C. Dapples. Vol. 35, No. 2; publication 1223. $1.00

"Reconstruction and Interpretation of Brittsia problematica D. White (Fern, Pennsylvanian)," by Hermann W. Pfefferkorn. Vol. 33, No. 17; publication 1224. $.75

"The Brain of 'Mesonyx,' a Middle Eocene Mesonychid Condylarth," by Leonard Radinsky. Vol. 33, No. 18; publication 1226. $1.00

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"Functional Morphological Models: Evolutionary and Nonevolutionary," by Robert E. DeMar. Vol. 33, No. 19; publication 1234. $1.00

"Paracanthopterygian and Acanthopterygian Fishes from the Upper Cretaceous of Kansas," by David Bardack. Vol. 33, No. 20; publication 1235. $1.00

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"Ordovician Batophoreae (Dasycladales) from Michigan," by Matthew H. Nitecki. Vol. 35, No. 4; publication 1236. $1.00

"Type Fossil Mollusca (Hyolitha, Polyplacophora, Scaphopoda, Monoplacophora, and Gastropoda) in Field Museum," by G. G. Forney and Matthew H. Nitecki. Vol. 36; publication 1239. $9.50

"Upper Devonian Receptaculites Chardini n. sp. from Central Afghanistan," by Matthew H. Nitecki and Albert F. de Lapparent. Vol. 35, No. 5; publication 1242. $2.00

Fieldiana Zoology

"Philippine Zoological Expedition, 1946-1947, Millipeds of the Genus Polydesmorhachis Pocock (Polydesmida: Platyrhacidae)," by Richard L. Hoffman. Vol. 65, No. 6; publication 1207.

"An Additional New Stenus from Australia (Coleoptera, Staphylinidae) 100th Contribution to the Knowledge of Steninae," by Volker Puthz. Vol. 65, No. 7; publication 1212. $.75

"Notes on Rodents of the Genus Gerbillus (Mammalia: Muridae: Gerbellinae) from Morocco," by Douglas M. Lay. Vol. 65, No. 8; publication 1213. $1.00

"Taxonomy and Evolution of Liontail and Macaques (Primates: Cercopithecidae)," by Jack Fooden. Vol. 67; publication 1216

"An Evaluation of Seth E. Meek's Contributions to Mexican Ichthyology," by Robert Rush Miller. Vol. 69, No. 1; publication 1232. $1.50

"Review of the Pselaphid Beetles of the West Indies (Coleoptera: Pselaphidae)," by Orlando Park, John A. Wagner, and Milton W. Sanderson. Vol. 68; publication 1240. $4.25

"Rhinodoras boehlkei, A New Catfish from Eastern Ecuador (Osteichthyes, Siluroidei, Doradidae)," by Garrett S. Glodek, Glenn L. Whitmire, and Gustavo Orces V. Vol. 70, No. 1; publication 1241

"Supplementary Catalogue of Type Specimens of Reptiles and Amphibians in Field Museum of Natural History," by Hymen Marx. Vol. 69, No. 2; publication 1243. Price to be announced.

In addition to its continuing Fieldiana series, Field Museum Press also published in 1976 the monograph *Endodontoid Land Snails from Pacific Islands* (Mollusca: Pulmonata: Sigmurethra), Part I, Family Endodontidae, by Alan Solem; 508 pp., $31.50. This work may also be ordered from the Division of Publications.

Field Museum has also reissued the popular *Mummies*, by Richard A. Martin, in conjunction with the "Treasures of Tutankhamun" exhibit opening April 15. First published in 1945, the 48-page booklet has now been revised and updated by David P. Silverman, project Egyptologist for the forthcoming exhibit. Lavishly illustrated with new bibliography. Price to be announced.

Books

Birds of Nepal with Reference to Kashmir and Sikhim, *by Robert L. Fleming Sr., Robert L. Fleming Jr. and Lain Singh Bangdel; published by Robert L. Fleming Sr. and Jr., Box 229, Kathmandu, Nepal; 349 pp., 150 color plates. $15.50 at Field Museum Shop; 10% discount for members.*

It was with real delight that I received my long-awaited copy of *Birds of Nepal.* Bob Fleming Sr. has been a field associate and friend of Field Museum for more than 40 years, and a resident for more than 20 years of Nepal, where he served as representative of the Board of World Missions of the Methodist Church. Fleming has sent the Museum hundreds of bird and mammal specimens, including new records for the country. This field guide to the birds of Nepal is a fitting culmination to Fleming's lifetime of collecting and observing the avifauna of the Himalayas. For the last 10 years, Bob Jr. has worked with him, adding many new species to the known avifauna. The new book is a field guide that will serve all the western Himalayas as well as Nepal.

In the introduction are descriptions of the different life zones of Nepal, which, in such a mountainous country, must be defined by altitude, and a guide to birdwatching in Nepal. Then follows the heart of the book—portraits in color of each species, with explanatory text on the facing page. The latter condenses a surprising amount of information into a short paragraph: altitudinal range, length, seasonal status, abundance, habitat, field marks, voice, status in Kathmandu Valley where most birdwatching will be done, and range in the Himalayas. Finally, there are two appendices listing those birds found in Kashmir and Sikhim, but not in Nepal. On the endpapers are maps of Nepal as a whole and of the Kathmandu Valley.

The colored plates—the key to a successful field guide—are beautiful. Two Nepalese artists have done a fine job of rendering the birds lifelike, and the color reproduction is excellent. By having the text on the facing page, the maximum number of figures on a given plate is seven or eight, and there is none of the crowding that so often characterizes field guides. *Birds of Nepal* should be as useful in the field as it is attractive in the hand.

The sequence of families followed in this book will be unfamiliar to those raised on Peterson's guides, but this is of little consequence, for many of the families will be equally unfamiliar. Just the names of the pittas, minivets, barbets, scimitar-bills, honey-guides, tragopans and griffons should excite any bird-watcher to head for his nearest travel agent. Publication of this guide should do much to stimulate interest in the birds of the Himalayas, an area that heretofore has only been covered in multi-volume works.

Not least important is the fact that with faith and determination, the Flemings were their own publishers, and not only wrote their book but supervised every aspect of its production in Bombay. This was no trifling task, for the distance from Kathmandu to Bombay is roughly that from Chicago to Denver. Now their labors have been rewarded, and we are the beneficiaries.—*Melvin Traylor, curator of birds*

Index to Field Museum of Natural History Bulletin, Volume 47 (1976)

Titles

Ancient Ecuador Revisited, by Jorge G. Marcos, Donald W. Lathrap, and James A. Zeidler: June, p. 3
Anthropologist in China, An, by Berthold Laufer: Feb., p. 3
Backward Glance, A: Field Museum 75, 50, and 25 years ago: Sept., p. 9
Between Friends/Entre Amis, new exhibit opens: June, p. 9
Blackball Mine: Haven for Bats, by Thomas Lera: March, p. 3
Botany of the Black Americans, by William Ed Grime (book review): May, p. 18
Cash, Cannon, and Cowrie Shells: The Nonmodern Moneys of the World, by Bennet Bronson: Nov., p. 3
Cashinahua of Eastern Peru, The, Jane Powell Dwyer, ed. (book review): July/Aug., p. 18
Early Chicagoland, by Philip Hanson: May, p. 3
Exhibit of Whale Pictures and Poems: May, p. 8
Field Museum-Street Peruvian Expedition, 1976, The, by John J. Pizzimenti: Oct., p. 3
Fish Collecting in Belize, by David W. Greenfield and Terry Greenfield: Jan., p. 3
Forty-six Years Ago: Feb., p. 18
From Birth to Flight: evolution of pterosaur model in Stanley Field Hall: June, p. 10
Gemstones: Beware and Be Aware, by Edward Olsen: July/Aug., p. 4
George Langford, 1876-1964, by Eugene S. Richardson: Feb., p. 10
Harvest of a Quiet Eye, by Charles F. Davis (book review): May 18
Here's to the Amethyst, by Patricia M. Williams: Jan., p. 11
Hickory Creek Revisited, by James Bland: Jan., p. 8
I Wear the Morning Star, new exhibit opens: Nov., p. 8A
Inching along to a Metric America, by Edward Olsen: Sept., p. 12
Iroquois Prayer: Intention and Anticipation, by David Blanchard: April, p. 12
Major Acquisition:, A, Field Museum receives bequest of important beetle collection, by Henry Dybas: June, p. 12
Members' Field Trip to Michigan: Sept., p. 11
Members' Nights, May 6 and 7: May, p. 9
Members' Tours to Egypt: Oct., p. 11
Nineteen Twenty-one: Field Museum's New Home: April, p. 10
Pawnee Earth Lodge, The, by John White: May, p. 12
Pollen, by William Burger and Christine Niezgoda: Sept., p. 3
Pterosaur, by John Bolt: May, p. 14
Sahara: The Growing Giant, by Burt Ovrut and Susan Ovrut: Oct., p. 12
Scanning Electron Microscopy Summer Workshop: April, p. 19
Shedding Light on "Discovery," by Sally Parsons: Sept., p. 7
Tenth Anniversary for Women's Board, by Ellen Thorne Smith: June, p. 14
Treasures of Tutankhamun, by David P. Silverman: Dec., p. 3
Trees of Stone, by Edward Olsen; Feb., p. 12
Trilobites: Creatures from the Ancient Seas, with photos by Riccardo Levi-Setti: March, p. 6
Volunteers Honored: March, p. 14
Weekend Trip for Geology Buffs: April, p. 20
Western Australian Field Program, by Alan Solem: July/Aug., p. 8 "Whip-poor-will": July/Aug., p. 3
Wilderness Canoe Trip: April, p. 21

Authors

Blanchard, David: *Iroquois Prayer: Intention and Anticipation*: April, p. 12
Bland, James: *Hickory Creek Revisited*: Jan., p. 8
Bolt, John: *Pterosaur*: May, p. 14
Bronson, Bennet: *Cash, Cannon, and Cowrie Shells: The Nonmodern Moneys of the World*: Nov., p. 3
Burger, William (with Christine Niezgoda): *Pollen*: Sept., p. 3
Davis, Charles F.: *Harvest of a Quiet Eye* (book review): May 18
Dybas, Henry: *A Major Acquisition*: Field Museum receives bequest of important beetle collection: June, p. 12
Greenfield, David W. (with Terry Greenfield): *Fish Collecting in Belize*: Jan., p. 3
Greenfield, Terry (with David W. Greenfield): *Fish collecting in Belize*: Jan., p. 3
Grime, William Ed: *Botany of the Black Americans* (book review): May, p. 18
Hanson, Philip: *Early Chicagoland*: May, p. 3
Lathrop, Donald W. (with Jorge G. Marcos and James A. Zeidler): *Ancient Ecuador Revisited*: June, p. 3
Laufer, Berthold: *An Anthropologist in China*: Feb., p. 3
Lera, Thomas: *Blackball Mine: Haven for Bats*: March, p. 3
Levi-Setti, Riccardo: *Trilobites: Creatures from the Ancient Seas*: March, p. 6
Marcos, Jorge G. (with Donald W. Lathrap and James A. Zeidler): *Ancient Ecuador Revisited*: June, p. 3
Niezgoda, Christine (with William Burger): *Pollen*: Sept., p. 3
Olsen, Edward: *Gemstones: Beware and Be Aware*: July/Aug., p. 4
———: *Inching along to a Metric America*: Sept., p. 12
———: *Trees of Stone*: Feb., p. 12
Ovrut, Burt (with Susan Ovrut): *Sahara: The Growing Giant*: Oct., p. 12
Ovrut, Susan (with Burt Ovrut): *Sahara: The Growing Giant*: Oct., p. 12
Parsons, Sally: *Shedding Light on "Discovery"*: Sept., p. 12
Pizzimenti, John J.: *The Field Museum-Street Peruvian Expedition, 1976*: Oct., p. 3
Richardson, Eugene S.: *George Langford, 1876-1964*: Feb., p. 10
Silverman, David P.: *Treasures of Tutankhamun*: Dec., p. 3
Solem, Alan: *Western Australian Field Program*: July/Aug., p. 8
Smith, Ellen Thorne (Mrs. Hermon Dunlap Smith): *Tenth Anniversary for Women's Board*: June, p. 14
White, John: *The Pawnee Earth Lodge*: May, p. 12
Williams, Patricia M.: *Here's to the Amethyst*: Jan., p. 11
Zeidler, James A. (with Jorge G. Marcos and Donald W. Lathrap): *Ancient Ecuador Revisited*: June, p. 3

Subjects

acid rain: Sept., p. 15
aggry beads: Nov., p. 15
Akodon jelski (chocolate mouse): Oct., p. 7
alligator, American: Jan., p. 17
Allport, Sydney (volunteer): Sept., p. 7
Alter, Joanne H.: Feb., p. 20
altiplano: Oct., p. 6
amethyst: Jan., p. 11
Anadara tuberculosa: June, p. 6
Anderson, Carrie F. (volunteer): March, p. 15
Anderson, Cleo M. (volunteer): March, p. 15
Armstrong, Judy (staff): Nov., p. 8B
Arner, Michael: March, p. 17
Australia: July/Aug., p. 8
Automeris io: July/Aug., p. 3
Ayer film-lecture series: Nov., 8B
Azorella: Oct., p. 7
Baird, Gordon (staff): Nov., p. 8B
bald eagle: Apr., p. 5; July/Aug., pp. 11, 13; Sept., p. 17
bats: March, p. 3
bayou darter: Jan., p. 16
Belize, collecting fish in: Jan., p. 3
Benton, Colbee: May, p. 5
Bernal, Ignacio: July/Aug., p. 14
Beverly, Leslie (volunteer): March, p. 15
Bicentennial award for Field Museum: Jan., p. 22
bighorn sheep: Apr., p. 3; Sept., p. 17
Bilandic, Michael: Jan., p. 22
Birds of America, The (Audubon): July/Aug., p. 3
birok (pig money): Nov., p. 5 ➤

black oak: July/Aug., p. 3
blackbird: Apr., p. 5
Blackmon, Carolyn (staff): Sept., p. 7
Blaschke, Frederick (staff): Feb., p. 19
Bolt, John (staff): March, p. 17
Bowen, Idessie (volunteer): March, p. 15
Briscoe, Carol (volunteer): Sept., p. 8
broad-winged hawk: Apr., p. 7
burro: Apr., p. 3; Sept., p. 17
Bushman: Feb., p. 22
Calhoun, Louva (volunteer): March, p. 14, 15
Canadian goose: Apr., p. 4
carbon monoxide: Apr., p. 9
Carnes, Alice (staff): March, p. 17
Carrion, Leonard (staff): Apr., p. 11
"cash": Nov., p. 9
Castrop, Julie (staff): Sept., p. 7
Caton, John: May, p. 6
Cawthon, David A. (staff): Nov., p. 8B
Cedros Island mule deer: Jan., p. 16
Cerambycidae of North America: June, p. 13
Cerithidea pulchra: June, p. 6
Chachani: Oct., p. 6
Champagne-Urbana, Ill.: July/Aug., p. 12
Chemsak, John: June, p. 13
Chicago, settlement of: May, p. 3
Chicago Herpetological Society: Oct., p. 10
China: Feb., p. 3
Chorrera: June, p. 4
coins, ancient: Nov., p. 7
Collier, Donald (staff): July/Aug., p. 14
Collier, John, Jr.: July/Aug., p. 15
Collier, John, Sr.: July/Aug., p. 14
Collier, Malcolm: July/Aug., p. 15
Condit, Carl W.: Feb., p. 20
Cornell University Laboratory of Ornithology: Apr., p. 5
cotton bollworm: Apr., p. 9
cotton budworm: Apr., p. 9
cougar (California): Sept., p. 15
cowrie shells: Nov., p. 12
Craft, Kinuko Y.: March, p. 16
crocodile, American: Jan., p. 16
Cukers, Velta (volunteer): March, p. 15
Daley, Richard J.: Jan. p. 22
Davis, Charles: Feb., p. 20
DeBlase, Alyce (volunteer): March, p. 14
Dentalium (shell money): Nov., p. 6
Desmond, Adrian: July/Aug., p. 14
De Visser, John : June, p. 2
Draeger, Harlan: Feb., p. 20
Drews, Lucy A. (staff): Nov., p. 8B
Duke, Gary: July/Aug., p. 16
Dutch elm disease: July/Aug., p. 12
Eckley, Alice (volunteer): March, p. 15
Eichholtz, Gretchen (staff): Feb., p. 22
Ekman, Anne (volunteer): March, p. 15
El Misti: Oct., p. 4
elk: Apr., p. 3
Elm Research Institute: July/Aug., p. 12
endangered species, breeders of: Sept., p. 16
Engel, John (staff): July/Aug., p. 9
Eppler, Myra: May, p. 13
Erdman, Lee (volunteer): Sept., p. 7
Ericksen, Bob: Feb., p. 20
Ericksen, Joan Root: Feb., p. 20
Eskimo pipes stolen: Apr., p. 18; Sept., p. 8
Estrada, Rolando: Oct., p. 4
European elm bark beetle (*Scolytis multistriatus*): July/Aug., p. 12
falconry: Apr., p. 7
False Face Society: Apr., p. 16; July/Aug., p. 17
Fay, John J. (staff): Nov., p. 8B
fish, blind cave: Jan., p. 6
fisher (W. Virginia): July/Aug., p. 11
Formative period (Ecuador): June, p. 3
Foster, Robin B.: Feb., p. 22
Gayford, Peter (volunteer): March, p. 14
gemstones, (diagram): July/Aug., p. 3
Ghost Dance: Nov., p. 8A
Gilpin, Orville (staff): March, p. 16
golden eagle: Apr., p. 5
grackle: Apr., p. 5
Great Meteorite Hunt, The: July/Aug., p. 7
Grigelaitis, Victoria (staff): Nov., p. 8B
Grove, Sam (staff): July/Aug., p. 12
Grutzmacher, Harold M. (staff): July/Aug., p. 15
Gurewitz, Sol (volunteer): March, p. 14
Haldane, J. B. S.: June, p. 12
Hall, John S.: March, p. 5
Hawaii creeper: Jan., p. 6
Hicks, Robert (volunteer): March, p. 14
Hirsch, Harry G.: March, p. 16; Nov., p. 8B
Horicon National Wildlife Refuge: Apr., p. 4
Hubbard, Gurdon S.: May, p. 4
Humbard, Dave (volunteer): Sept., p. 8
Hutchinson, G. E.: June, p. 12
Huysmans, Fred (staff): Apr., p. 11; Sept., p. 2, 3
Hyalophora cecropia: July/Aug., p. 3
ichu grass: Oct., p. 7
Illinois Arts Council: March, p. 14
Iltis, Hugh H.: Feb., p. 20
Indiana bat (*Myotis sodalis*): March, p. 4
Japanese language museum guide: Nov., p. 8C
Jim Ella: May, p. 13
Jordan, Julia (volunteer): March, p. 15
Juniperella mirabilis: June, p. 13
Keller, Laurel E. (staff): July/Aug., p. 8
Kennedy, Helen (staff): March, p. 15
Kennicott Club: Feb., p. 22
Kethley, John (staff): July/Aug., p. 9; Feb., p. 22
King Tut: Dec., special issue on Tutankhamun
Kinzie, Juliette: May, p. 6
Kirtland's warbler: Jan., p. 16
Klein, Lawrence (staff): Feb., p. 22
Klepinger, Linda: June, p. 6
Knull, Dorothy (Mrs. Joseph N.): June, p. 13
Knull, Joseph N.: June, p. 12
Kosky, Laurie (volunteer): March, p. 15
Lambeosaurus: March, p. 16
Langford, George (staff): Feb., p. 10
Lauf, William J. (staff): Feb., p. 22
Laufer, Berthold (staff): Feb., p. 3; Oct., p. 10
Lewis, Phillip, named chairman of Department of Anthropology: Jan., p. 22
Liebman, Elizabeth (staff): July/Aug., p. 9
Lignasan BLP: July/Aug., p. 12
Linsley, E. Gorton: June, p. 13
little brown bat (*Myotis lucifugus*): March, p. 4
Lukoschus, Fritz: July/Aug., p. 8
Lundelius, Ernst: July/Aug., p. 9
MacBride, J. Francis (staff—obit.): Sept., p. 18
de Macedo, Hernando: Oct., p. 4
Machalilla: June, p. 4
MacLeod, Stewart (volunteer): March, p. 14
Malone, Robert: June, p. 10
marine turtles: Sept., p. 14
membership: Feb., p. 22; Nov., p. 8C
meteorites: July/Aug., p. 7
Metric Conversion Act: Sept., p. 13
metric system: Sept., p. 12
Migratory Bird Treaty Act: July/Aug., p. 16
Mockler, Walter (volunteer): March, p. 14
monarch butterfly: Oct., p. 2
money: Nov., pp. 1-15
Mortimer, Mike (staff): Oct., p. 3
Moseley, Michael E. (staff): Nov., p. 8B
mourning dove: Sept., p. 14
Mudloff, Carol (volunteer): Sept. p. 7
Mueller, Le Moyne (volunteer): March, p. 14
Myotis lucifugus (little brown bat): March, p. 4
Myotis sodalis (Indiana bat): March, p. 4
National Science Foundation: July/Aug., p. 9
native elm bark beetle (*Hylurgopinus rufipes*): July/Aug., p. 12
Nebkheperura (King Tutankhamun): Dec., p. 3
Nelson, Nancy (volunteer): Sept., p. 7
Newell's Manx shearwater: Jan., p. 16
Nordhouse (Mich.) Dunes Area: Apr., p. 9
Nyctosaurus gracilis: May, p. 17
O'Brien, John (volunteer): March, p. 14
olive trees: Oct., p. 17
Olsen, Edward, named chairman of Department of Geology: Jan., p. 22
Onyx Bridge: Feb., p. 13
Oryzomys (rice rats): Oct. p. 4
Osborne, Effie: May, p. 13
Osborne, Sam: May, p. 13
osprey: Apr., p. 5
Paling, John : Nov., p. 8B
Palmer, James: June, p. 14
Paragould meteorite: Feb., p. 18
passenger pigeon: May, p. 7
Payne, Roger: Nov., p. 8B
PCBs: July/Aug., p. 10
pele: Nov., p. 12
peninsular pronghorn antelope: Jan., p. 16
"People Who Start Pollution Award": Apr., p. 9
Percina tanasi (snail darter fish): Sept., p. 16
peregrine falcon: Apr., p. 7; Sept., p. 17
Peru: Oct., p. 3
Petersen, Glenn (staff): Sept., p. 8
Petrification: Feb., p. 12
Petrified Forest National Park: Feb., p. 1, 13
Phacops rana milleri: March, p. 2
Phyllotis darwini: Oct., p. 4
pig money (*birok*): Nov., p. 5
pollen: Sept., p. 3
Po'o uli: Jan., p. 16
Polylepis: Oct., p. 7
Price, Laurie: July/Aug., p. 9
Pteranodon: May, p. 15
pterodactyl: May, p. 15
pterosaur: May, p. 15; June, p. 10
puna: Oct., p. 7
Pgymy Society: Apr., p. 17
Quercus borealis: July/Aug., p. 3
"Quiet Day": Apr., p. 9
Rabb, George: Feb., p. 20
Rada, M. E. (volunteer): March, p. 14
Ralte, Lalchumi (volunteer): March, p. 14
Raptor Rehabilitation Center (U. of Minn.): July/Aug., p. 16
Real Alto, Ecuador: June, p. 3
red oak: July/Aug., p. 3
red-tailed hawk: Apr., p. 8

rehabilitation of Field Museum: Apr., p. 11
Resetar, Alan (staff): Nov., p. 8B
Rettig, Cheryl: Feb., p. 20
Rettig, Neil: Feb., p. 20
Rhamphorhynchus: May, p. 2, 17
Samuelson, Bonnie (volunteer): Sept., p. 8
scanning electron microscope: Apr., p. 9, 11
Schneider, Alice (volunteer): March, p. 14
Scholl, Carol (staff): Nov., p. 8B
Schmidt, Karl P. (staff): Feb., p. 19
Scioto madtom: Jan., p. 16
sea turtles: Sept., p. 14
SEM: Apr., p. 9, 11
Shanower, Ann (volunteer): March, p. 15
shell money: Nov., p. 11
Sipiera, Paul: July/Aug., p. 7
snail darter fish (*Percina tanasi*): Jan., p. 16; Sept., p. 16
snails: July/Aug., p. 10
sodium cyanide poison for coyotes: Jan., p. 17
Spanish language museum guide: Nov., p. 8C
starling: Apr., p. 5
Stevenson, Dorothy (volunteer): March, p. 14
Stoneburg, Beth (volunteer): Sept., p. 8
Street, Janice (Mrs. William S.): July/Aug., p. 8; Oct., p. 3
Street, William S.: July/Aug., p. 8; Oct., p. 3
Sudan: Oct., p. 12
Swarthchild, James (volunteer): March, p. 14
Tax, Sol: May, p. 12
temperature, global: Apr., p. 8
1080: Apr., p. 8
Terrel, John (staff): Oct., p. 10
Thomas, Jacob: July/Aug., p. 17
tola: Oct., p. 7
tridacna as money: Nov., p. 3
trilobites: March, p. 2, 6
Turnbull, William (staff): July/Aug., p. 9, 14
turtle, marine: Jan., p. 17
Tutankhamun: Dec., p. 3
Tutankhaton: Dec., p. 3
Validivia: June, p. 4
Vandalism on natural resource lands: July/Aug., p. 11
VanStone, James (staff): Sept., p. 8
Vespula germanica: Jan., p. 16
vitamin C: Sept., p. 15
Voris, Harold, Kennicott Club speaker: Jan., p. 22
Voris, Helen (volunteer): March, p. 14
wampum: Nov., p. 12
Webber, E. Leland (staff): Jan., p. 22; March, p. 15
Wellnhofer, Peter: May, p. 2
Wermuth, Karen: June, p. 10
whale pictures and poems, exhibit of: May, p. 8
White, John (staff): May, p. 12, 13
Whitmer, La Donna (volunteer): March, p. 15
Wild Horse and Burro Act of 1971: Apr., p. 3; Sept., p. 17
wild horses: Apr., p. 3; Sept., p. 17
Williams, Kevin (staff): May, p. 12, 13
Wing, Elizabeth: June, p. 5
Winter, Blair (volunteer): March, p. 14
wolves (Alaska): July/Aug., p. 11
wolves (Mexican): July/Aug., p. 13
Wounded Knee: Nov., p. 8A
Wovoka: Nov., p. 8A

A Major Operation

(The following article first appeared in the May, 1932, Field Museum News *(former name of the* Bulletin*), and was written by Berthold Laufer, then curator of the Department of Anthropology. The stone turtle may still be seen in Hall 24.)*

In this time of reductions, when the weight of ladies, income, wages, and almost everything except taxes is reduced, the following story may merit rescue from oblivion.

Although the incident is posted on a label explaining an exhibit at the north end of the East Gallery (George T. and Frances Gaylord Smith Hall), many visitors to the Museum may have missed their chance to read a curious story. The exhibition case in question contains a single large monument—a huge turtle sculptured from stone as the support of a tablet inscribed in Chinese. This turtle has been in existence for exactly 1,190 years.

In 1908 when traveling in China and Tibet on behalf of Field Museum, I spent several months at Si-an-fu, the center of the ancient Chinese civilization. One day this turtle was carried into my courtyard by four men of herculean physique. It is carved from a solid block of stone, and it then weighed about 1,200 pounds. Immediately the thought of the cost of its transportation to Chicago loomed in my mind and was a source of great concern to me.

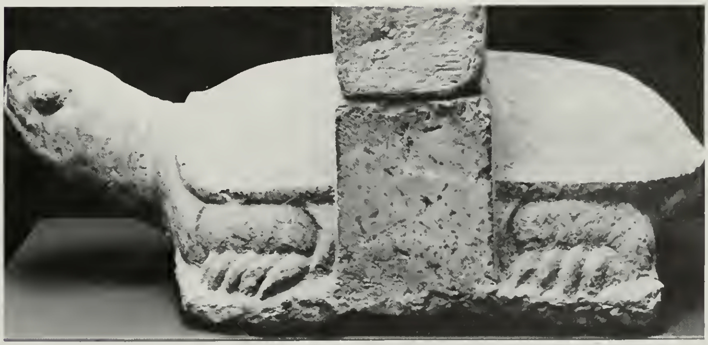
Five hundred large boxes filled with numerous antiques had already accumulated as the result of my treasure hunts, and were awaiting transportation on mule carts to Honan-fu, the nearest railroad center (present seat of the Chinese government).

It was a journey of from eight to ten days (depending on weather and road conditions) to reach that point. The normal freight rate at that time was $8 per cart, but unscrupulous speculators took advantage of my situation and drove the price up to $18, intimidating the muleteers, who were kept away from me. It took two weeks of negotiations to break this conspiracy, and little assistance was received from the local government, which was powerless against these racketeers.

The turtle therefore had to be reduced in weight to save expenses, not only in transportation on the mule carts, but also in railroad freight from Honan to Hankow, in steamer freight on the Yangtse from Hankow to Shanghai, and finally on the ocean steamer from Shanghai to Seattle. I hired two stonecutters who for three weeks operated on the turtle, pounding on its belly, boring into its interior and hollowing its entrails out, removing masses of superfluous stone to the extent of 460 pounds. This reducing process resulted in a savings of several hundred dollars in the cost of transporting it to Chicago.

Although now reduced to 740 pounds, the good turtle has not changed its appearance or equanimity. It still is as complete, robust, and steadfast as before, According to Chinese belief, the turtle is an emblem of longevity, strength, and endurance, and is reputed to reach an age up to three thousand years.

Stone turtle, on view in Hall 24.



January at Field Museum

JUST OPENED

The Place for Wonder. Visit the newly opened *The Place for Wonder* gallery. Open to visitors of all ages, this room provides a "hands-on" approach to numerous natural history specimens and artifacts. The gallery is staffed by museum volunteers and is open to the public: weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to 3 p.m. Ground floor.

NEW PROGRAM

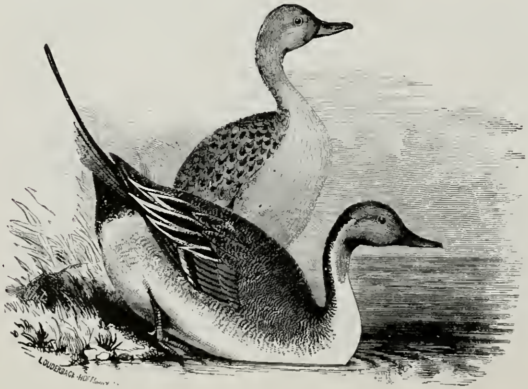
Japanese Noh Drama Performance. Thursday, January 27, high school and college-age persons are invited to a demonstration/performance of the ancient Japanese noh drama, Sotoba Komachi—a tale of demons. This multi-media demonstration is performed at 10 a.m. and repeated at 11 a.m. and 1:15 p.m. in Simpson Theatre, ground floor. Reservations are necessary for admittance. Write Group Programs, Field Museum.

SPECIAL EXHIBITS

I Wear the Morning Star. Exhibit of garments and objects designed by Western Plains Indians for the Ghost Dance, a pacifistic religious movement borne of one man's impressive visions and adapted by 30 tribes in the late 19th century. Hall 9. Through Feb. 6.

Male and Female: Anthropology Game. This exhibit of 38 artifacts is a great way to learn that economic and social roles of the sexes are not universally the same. South Lounge, 2nd floor. No closing date.

Man in His Environment takes a global view of some of the most serious environmental problems confronting all mankind and asks visitors to involve themselves in these problems—and the need for solution. Hall 18. No closing date.



Pliny's Natural History: The First Encyclopedia. Two rare editions (1513 and 1530) of Pliny the Elder's work—viewed today as an astonishing mixture of fact and fiction—are on view in the South Lounge, 2nd floor. No closing date.

Pterosaur. A stylized model of the largest known flying creature—an extinct pterosaur—dramatizes a special exhibit of pterosaur fossils; Northwest Arcade, 2nd floor. No closing date.

CONTINUING PROGRAMS

Saturday Discovery Programs. Saturdays, 11 a.m. to 3 p.m.; take tours, follow demonstrations, participate in museum-related activities.

Winter Journey for Children: "All that Glitters." Throughout the ages, gold and silver have made poor men rich, built their empires, and filled everyone's teeth. A free, self-guided tour explores these elements and their properties. All children who can read and write are invited to participate; families will enjoy it too. Journey sheets available at information booth.

The Ancient Art of Weaving. Resumes Jan. 17. Members of the North Shore Weavers' Guild demonstrate weaving and spinning every Monday, Wednesday, and Friday, 10 a.m. to 12 p.m. South Lounge, 2nd floor.

SPECIAL-INTEREST MEETINGS OPEN TO THE PUBLIC

Jan. 4, 7:30 p.m.	**Kennicott Club**
Jan. 7, 8:00 p.m.	**Chicago Anthropological Society**
Jan. 11, 7:30 p.m.	**Chicago Nature Camera Club**
Jan. 11, 8:00 p.m.	**Chicagoland Glider Council**
Jan. 12, 7:00 p.m.	**Chicago Ornithological Society**
Jan. 12, 7:30 p.m.	**Windy City Grotto, National Speleological Society**
Jan. 13, 8:00 p.m.	**Chicago Mountaineering Club**
Jan. 18, 7:30 p.m.	**Chicago Audubon Society**

JANUARY HOURS

The Museum Opens daily at 9 a.m., closes at 4 p.m. weekdays and 5 p.m. weekends. On Friday's, year-round, the museum is open to 9 p.m. Food service areas are open weekdays 11 a.m. to 3 p.m., weekends to 4 p.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday (closed Jan. 3). Obtain pass at reception desk, main floor north.

Museum Telephone: 922-9410

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President and Director: **E. Leland Webber**

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CONTENTS

3 **Valcamonica: World's Richest Treasury of Rock Carvings**
by Lois Bolton Lundy

8 **The Return of the Fisher**
by Roger A. Powell

13 **"Treasures of Tutankhamun" Dinner-Lecture Series**

14 **Letters from Antarctica, 1976-77**
by Edward Olsen

16 **Books: Legion of Night,**
A study of the moth genus Catocala, *by Theodore D. Sargent*

17 **Edward E. Ayer Film Lecture Series**

18 **Field Briefs**

back cover **February at Field Museum**
Calendar of coming events

COVER

A Roman cinerary urn from the 1st century A.D. Cinerary ash urns have a wide distribution, and are known from tombs in France, Germany, Italy, central Europe, Spain, Syria, and Egypt. Vases of this type were also used for household purposes. Some have been discovered with remnants of oil or fruit still inside. Others, containing the ashes of the dead, have come from ancient columbaria (vaults for urns). Glass cinerary urns were used from about the 1st century B.C. to about the middle of the 3rd century A.D., when cremation was superseded by burial in large sarcophagi.

The type of glass vase shown here was made by forming molten glass sheets into tubes or by pressing such a sheet into a mold. Upon exposure to air and moist earth, glass deteriorates progressively deeper from the exposed surface. The upper area separates into layers and the inner parts granulate or pulverize. The iridescence—due to the separate thin layers of the surface allowing light to refract from layer to layer as in a prism—is prized for its beauty. Since some types of ancient glass do not develop iridescence, this characteristic is often useful in the identification and study of a given piece. Height: 37.2 cm, width: 29.8 cm. Cat. No. 24606. Photo by Ron Testa.

*—Joyce A. Korbecki
scientific assistant
Department of Anthropology*

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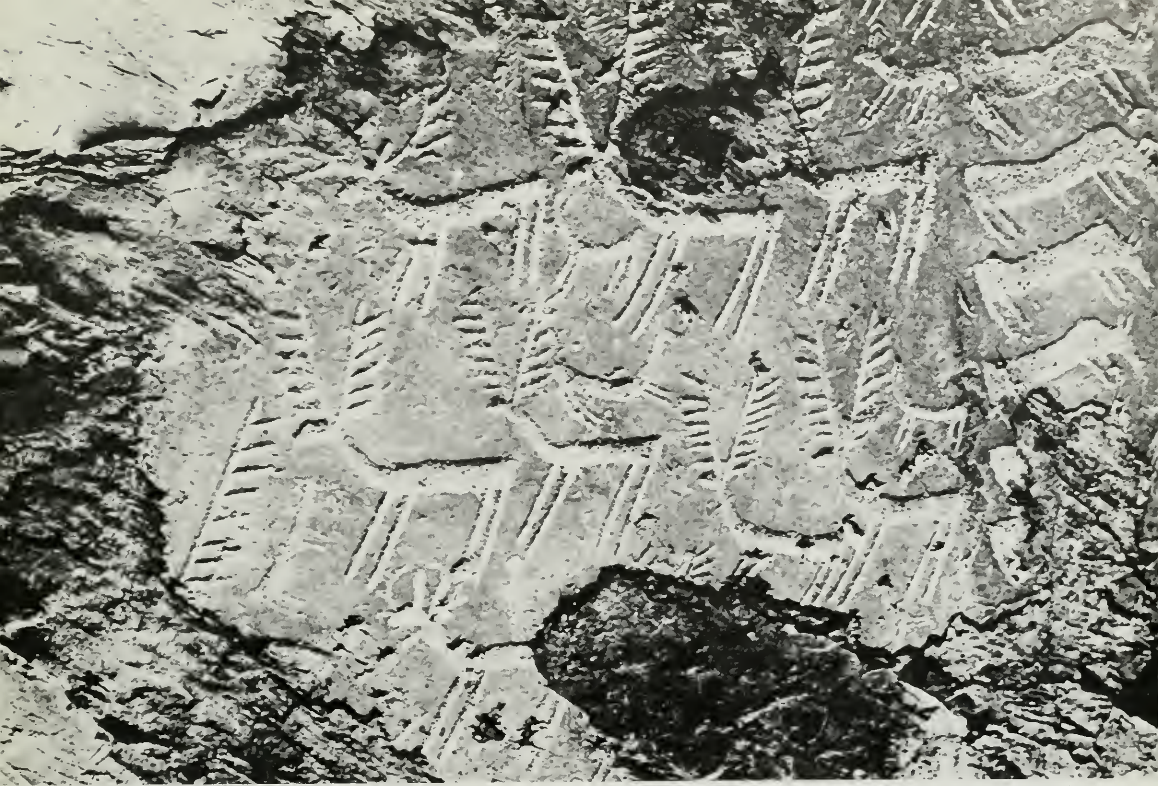

Bronze Age carving of elk found at Cemmo

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Valcamonica: World's Richest Treasury of Rock Carvings

By Lois Bolton Lundy

The richest concentration of rock art known in Europe today is to be found in a narrow, 75-kilometer-long valley of the Oglio River in the central Alpine area north of Brescia, in Lombardy, Italy. Some 130,000 engravings, discovered over a 20-year period, represent only an estimated 15 to 20 percent of the area's total treasures. Because of the enormous number of engravings, their superb state of preservation, and the clear stylistic identification of the epochs to which they belong, they comprise an important aid to understanding man's artistic, cultural, social, economic, and even political evolution. These rock carvings amount to an almost continuous 8,000-year-old diary of the daily life of the Camunian people from prehistory to the Roman occupation and beyond.

In the heart of the valley's rock-carving area is the village of Capo di Monte, where the Camunian Center for Prehistoric Studies (Centro Camuno di Studi Pristorici) is headquartered. The staff of the center, founded in 1964, is engaged in various aspects of archeological research, including exploration and laboratory analysis of carvings, as well as publishing, exhibitions, and seminars; the center also houses one of the world's most comprehensive libraries on rock art.

"Prehistoric research," observes Emmanuel Anati, director of the center, "contains all the premises to change our own lifestyles. Since it is

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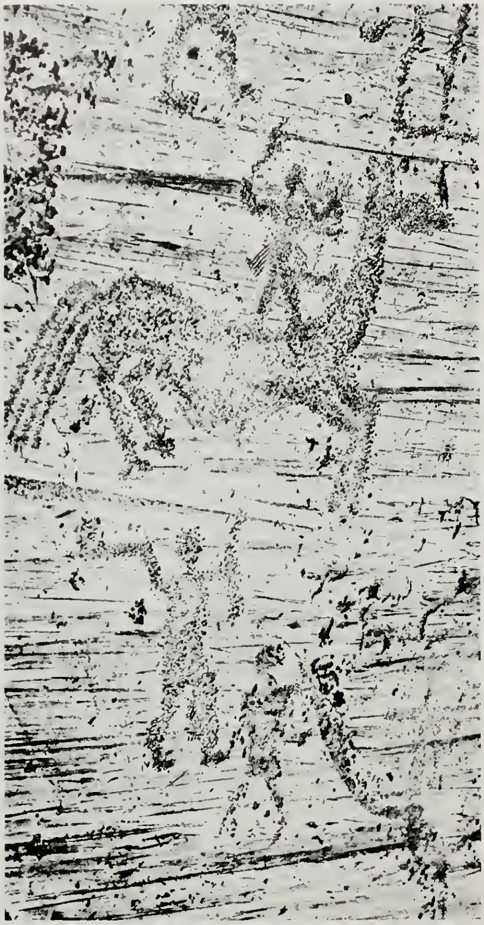
Lois Bolton Lundy is a former Field Museum staff member now living in Italy.



Battle scene found at Naquane Photo courtesy Lois Bolton Lundy

about man, his past, and his behavior, it concerns every one of us. It loses interest when the archaeologist and his followers see only objects to catalog or describe, without making any historical reconstruction. We're looking into the past to find the meaning of the present. In historic expression of human life, we search out the essence of a destiny uniting all men. We're looking for an identity and definition of our era and our society through continuous close contact with the vestiges of history."

Style

The rock-carvings of Valcamonica are divided into six periods, starting from a Pre-Boreal stage some 10,000 years ago and continuing to the Sub-Atlantic age on the eve of Romanization of the area in the first century B.C. Epi-Paleolithic hunting peoples etched images of animals, mainly elk, onto the rock—an exercise that may have been part of a ritual to ensure a successful hunt. Subsequent changes in style and subject matter reflect new material and ideological influences on the human community.

The evolution of art does not appear to follow a linear development. Each phase tends to reflect contemporary influences rather than a development out of the artistic style of previous generations. From the Palaeolithic to the Iron Age, elements of style can be analyzed as a search for expression, synthesis, simplification, or symbolizing of shapes. Each period reflects the aesthetic and intellectual values of the age, while the style and range of subject matter, the composition, and the artist's selection of area on the rock face indicate ideological-conceptual needs, together with the social, economic, and technological level of artists of the epoch.

Why Valcamonica?

When the valley's huge Pleistocene glacier retreated between 12,000 and 10,000 years ago, it left rock fashioned in fascinating, provocative shapes. Not only were the shapes a stimulus to man's imagination, but the glacier-smoothed surfaces were a clear invitation to self-expression. The Pre-Boreal climatic stage, which signaled the introduction of human life in Valcamonica, lasted approximately from 8,000 to 7,000 B.C. As temperatures rose and pine trees and birches began to grow in the valley, bands of hunters came in search of animal prey. These hunters are responsible for the oldest carvings in the area. At that time, fauna was still of a Pleistocene type, and elk, the largest member of the deer family, dominated this early period of rock carvings. As temperatures continued to rise in the successive Boreal period, and vegetation increased, the subarctic fauna which had occupied the valley for thousands of years began to disappear and various types of deer and wild goats appeared.

After a new cold spell—between 6,000 and 5,000 B.C.—which seems to have precluded human habitation in the valley, a new human presence returned in the Atlantic climatic period, a little before 5,000 B.C. It was the beginning of a generally warm, humid period in which man turned from the search for food to the production of food. The Camunians of this period put more emphasis on agriculture and introduced innovations into their own culture. This Atlantic period was followed by a cooling-off period, the Sub-Boreal stage, which lasted from 3,000 to 800 B.C. Fir trees, alders, pines, and oaks, in the lower altitudes, flourished while fields covered the valley. This was the period of maximum cultural, and perhaps even demographic development, among the Camunians.

From then on, there have been only minor climatic variations, with hot and cold spells occurring every 200 to 300 years, right down to the present day. Throughout all of these periods, the natural environment, the climate, the flora and fauna, and the economic resources shaped man's thinking, behavior and lifestyle. And rock art was a physical manifestation of man's reaction to his existence in this world.

Techniques

Exploration and discovery is the culmination of a lengthy process that starts with observation of preselected areas, aerial photographs, and the geological study of rocks appearing there. The prehistoric Camunian artist's favorite rock was fine-grain, Permian sandstone. The locations where this rock appears are naturally the first to be examined by archaeologists, although carvings may also be found on granite, conglomerate, and on schist—which means the whole valley must be explored. When carvings are found, the rocks must be cleaned and washed, the degree of deterioration studied, remaining incrustations examined, and the rock documented.

Many of the carvings were made with a pecking technique, which involved hammering on the surface with a pointed tool to create pock-marked areas and lines. There are also threadlike carvings made by scratching. Many of these are often invisible if the rock is not properly cleaned, so it was essential to find a way to provide a clearly legible and copiable surface. This minimized the possibility of errors in personal interpretation. When rock carvings are not clear enough to be seen by the naked eye, a preparation of "neutral" color is applied to bring the carvings into relief. This coloration method puts the smooth surfaces in chromatic contrast to the pecked areas and the natural cracks of the rock. All the characteristics of the engravings are thus rendered clearly evident and the differences in marks left by various instruments may be clearly distinguished. It also permits analysis of figure overlapping as a means of establishing stratigraphy.

The coloration also serves a protective function: the coloring used inhibits the growth of lichens and other organisms which otherwise readily attach to the surface. These organisms, which constitute one of the main causes of decay, are unable to grow on the rocks. Coloration also allows the observer to look at the carvings as they were seen by prehistoric man. The presence of coloring materials at the foot of some rocks and traces of colors in a few engravings indicate that prehistoric man colored his engravings. Deterioration accounts for their present uncolored appearance. The chromatic contrast is generally created by using black and white, though prehistoric man used yellow, red, brown, green, and violet as well. When the "neutral" (so-called because it eliminates personal interpretation) treat-

Iron Age stela at the Camuno Center

Photo courtesy Lois Bolton Lundy

ment is finished, the rock is ready for examination. Documentation then proceeds with a survey, tracings, photographs, and analysis of hammering and overlappings. This procedure leads to a study of all the data available on the rock surface.

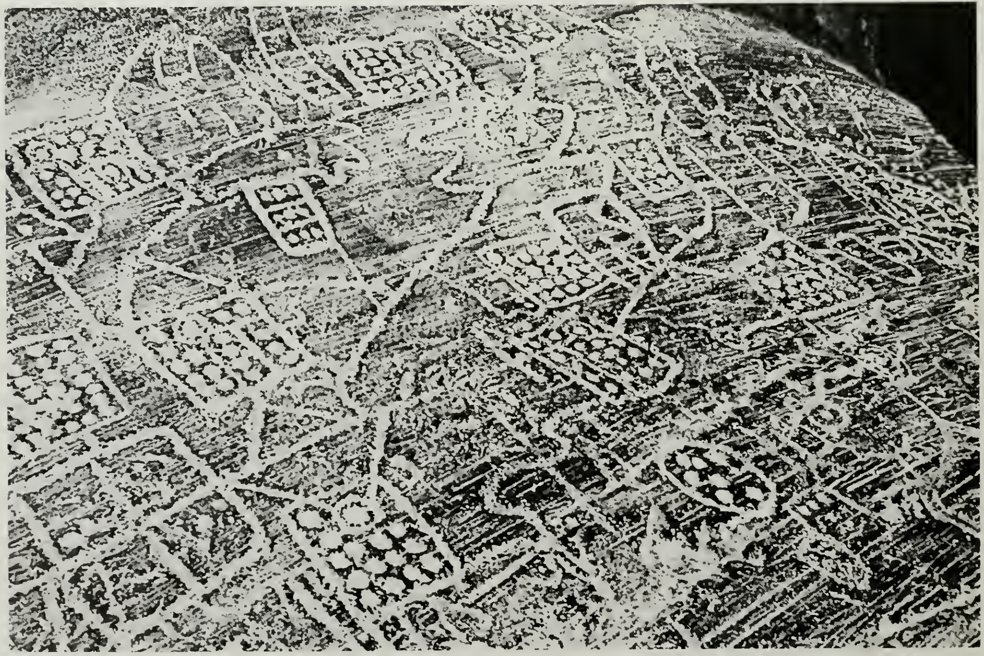
The great advantage of the life-size integral tracing is that it gives one the opportunity to define every mark on the rock, to the point of even distinguishing between individual peck marks. From the tracing, used as a record and integral part of research, the crucial analytical factors of the carving become apparent. It is possible to tell which of the marks were man-made, which occurred naturally, and whether natural cracks and forms were used by the carver as part of his engraving. One may determine whether a sketch was made prior to carving, what type of color was used, and the raw materials employed. Tracing often means reenacting the artist's original work, which leads to definition of the steps employed in the carving. Almost every rock, out of more than 800 recorded in recent years in Valcamonica, is full of innumerable details which the eye and mind of the researcher might not have picked up in their full significance without the preliminary treatment and time-consuming tracing.

Significance

The analysis of such a huge number of engraved rocks, recorded over the course of 20 years, creates a cultural context for the Camunian artist. All the elements of each single phase of existence are examined in order to reconstruct the artist's daily life: the technological level, arms and common tools, domestic animals bred, wild animals hunted, economic activities, beliefs, mythology, religion, family life, community work division, and the sociopolitical structure. One notes the new factors that entered into the culture over the course of thousands of years, making it increasingly more complex and distinctive.

The study in Valcamonica permits reconstruction of 8,000 years of cultural evolution from the arrival of the first bands of Epi-Paleolithic hunters through the various stages of tribal life, each with its own innovations, activities, and beliefs until the advent of the Romans and beyond. The eight-millenium sequence reveals the cultural processes which led to such a change in our existence — from a society made up of small bands of hunters to our contemporary civilization. □

Bronze Age map found at Bedolina



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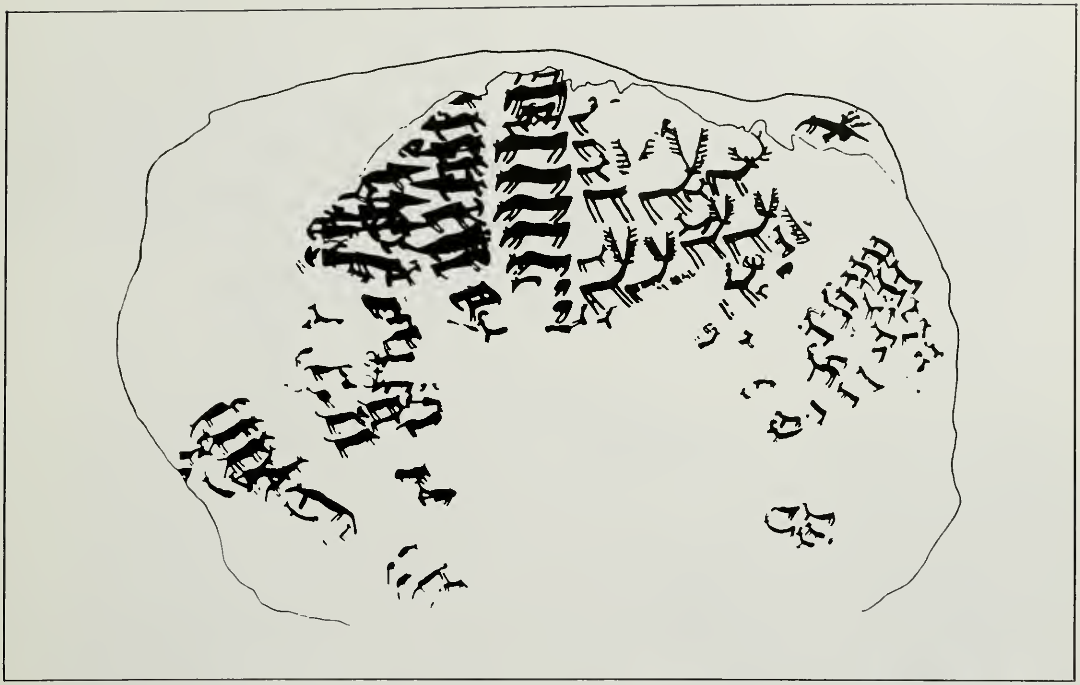

Above and below: Bronze Age compositions

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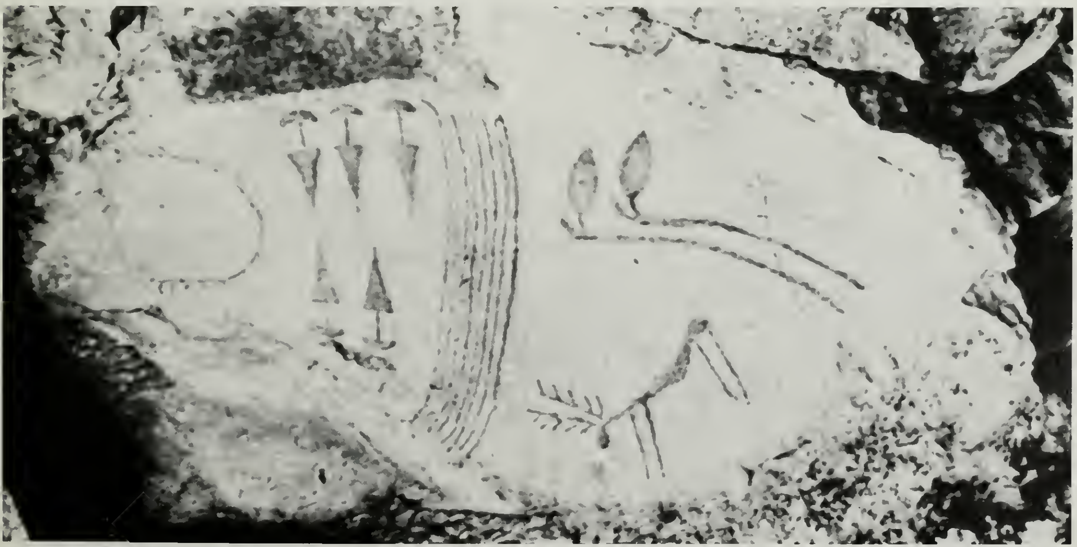

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The author, followed by his Newfoundland, searching out fishers in Upper Michigan.

Photos courtesy of the author

The Return of the Fisher

By Roger A. Powell

THE FIRST TIME I SAW A FISHER — a large member of the weasel family — I was driving down an old logging road in Superior National Forest, in northeastern Minnesota. A black object appeared at the edge of the road, streaked across in front of my jeep, and disappeared before I could even think "fisher." There is nothing particularily exciting about my experience, nothing unique or strange. The same scene occurs now and then to people in the woods wherever the fisher is found. It is becoming a more frequent (though still infrequent) scene in the western Upper Peninsula of Michigan. But this experience was a reinforcing factor which helped to convince me that I should study the fisher.

Since Autumn, 1973, I have been living in Ottawa National Forest, located in Michigan's Upper Peninsula and studying fisher ecology and behavior. The main thrust of my work has been to estimate the amount of energy that fishers burn up while running through the woods on their daily routine and consequently to determine how much food a fisher must eat in order to replace the energy burned. I have used a variety of laboratory techniques and much modern technology (oxygen analysis, calorimetry, radio telemetry) but the largest part of my data has been collected by means of such old-time equipment as a dog sled to haul gear and such old-time techniques as tracking in the snow.

During the winter, animals in northern climates leave trails in the snow which are much like books waiting to be read. I obtain a great deal of satisfaction from following animal tracks and determining what the animal I am following has been doing. If

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Roger A. Powell is a graduate student at the University of Chicago.

you were to accompany me in the woods one winter afternoon, you might have an experience much like the following.

Imagine that we are snowshoeing down an old unplowed logging road; it is still early winter and the snow is no deeper than 18 inches, so one of my Newfoundland dogs accompanies us for the fun of it. The dogs' major job is to haul traps, bait, and other gear and to haul fishers out of the woods when they have been live-trapped, but the dogs like to come along on hikes, too. We are lucky and before travelling too far, find a fresh fisher track crossing the logging road. By determining which direction the five toes on each foot point, we can tell the direction the fisher was travelling.

The track first leads downhill through open hardwood forest. Frequently the track goes along the tops of fallen trees, into hollow logs, and over old stumps. (Was he trying to get a better view of the forest from on top of a stump?) Fresh scratches on the bark of a tree and bark scrapings in the snow indicate that the fisher climbed a tree. The track resumes some ten feet from the tree, showing that the fisher jumped as he came down. Like squirrels, fishers can turn their hind feet around and come down a tree head-first.

Next, the track leads us into a thick spruce bog. Whereas the track went in a fairly straight line in the hardwood forest, now it hardly goes five feet without changing direction. The fisher must have snooped under and between each of the spruce trees looking for snowshoe hares, the tracks of which can be seen all over the bog. At the far side of the bog is a patch of thick alder which also has many hare tracks. The fisher track leads us through the alder very much as it led us through the spruce — lots of turns, lots of over-and-under. It must have been easier for the fisher to get through the thick tangle of alder than for us on showshoes.

Once through the alder, the fisher track begins to go uphill through more hardwoods. The going gets easier for us again, as the hardwood forest is fairly open. At one point the track makes a short "z" pattern just before a ten-inch-deep hole the fisher dug in the snow. Close scrutiny shows that there is a little spot of blood in the hole and some short hair at the bottom: the fisher caught a mouse. A short way further on is another hole in the snow, and this one is surrounded by feathers. There are only a few feathers, though, and no blood, so the fisher must have cleaned up the leftovers of a ruffed grouse killed by some other predator.

One mouse and a leftover grouse are hardly enough to satisfy a hungry fisher, which can devour an entire snowshoe hare in one sitting. Such a meal is enough to last a fisher for two to four days, and a fisher which catches a hare will usually take a long nap after dinner. The fisher we are following continues through the hardwoods in almost a straight line. A few zigzags here and there to snoop into hollow logs or run along fallen trees do not change his basic direction of travel. This sort of travel is so completely different from the travel in the bog that one might be surprised that it is the same animal. But after half to three-quarters of a mile of running through hardwood forest, the fisher track leads us right up to a porcupine den in a large hollow tree. The tracks get confusing here, because the fisher ran up and down the trails left by the porcupine going to and from his den tree and feeding trees. Old porcupine trails and fresh porcupine tracks make

"Like all members of the weasel family, fishers are curious; they like to inspect and to get a good view of everything that catches their eye."

◄ *Head of male fisher raised by Powell*

"Two fisher kits at about nine weeks. At this age, kits have had their eyes open for only one to two weeks and they are not completely weaned. Between eight and ten weeks of age these hand-raised fishers were fed a mash made from finely ground venison and a commercial milk formula. They regularly made a mess of themselves with the mash, and Kaloosit, our Newfoundland, cleaned their faces, a tongue being a better cleaner than a wash cloth. After ten weeks, they ate road-killed mammals and birds and live-trapped mammals. They were not able to kill a snowshoe hare, however, until four months of age." ▼

"I carefully cover a live-trap," says Powell, shown here. "This is mainly to keep the fisher calm and warm. Fishers like to snoop into cavelike places, so a trap that simulates a hollow log or the space under a spruce or fir tree made by snow is a natural place for a fisher to snoop. Fishers are excitable, and I had two fishers chew, bite, and claw their way through the traps, which are made of welded, 12-gauge steel wire. Covering the trap, making a dark, warm place for the fisher, keeps the animal calmer."

the fisher track hard to discern. The porcupine cannot be seen up in the nearby trees where the branches freshly stripped of bark show where he has been feeding. But a pound on the big opening of the den tree produces scratchy rustles far up inside the hollow tree as the porcupine moves further up and away from us. The fisher probably came by while the porcupine was up in a feeding tree. He could not kill the porcupine in the tree, so he went his way. The porcupine later came down out of the feeding tree and went into the hollow den tree, in which he is also safe. His daily winter schedule consists mostly of walking to his feeding trees in the early evening, eating during the night, and returning to his den in the morning.

Every once in a while a fisher will find a porcupine travelling from its den tree to a feeding tree. Under these circumstances the fisher has a chance of killing the porcupine. The weasel-shaped fisher is small enough and quick enough so that while circling the porcupine it can jump in whenever the opportunity arises and bite the porcupine on the face, where there are few quills. Then the fisher will jump back again before the porcupine can counterattack with its tail. The fisher is large enough to make a bad wound with each bite on the face. Several such wounds on the face during the course of thirty to forty-five minutes will slow down the porcupine so that the fisher can turn it over and begin to dine at the chest and belly. The myth that fishers turn porcupines over and kill them by biting the belly probably originated from observations of fisher-killed porcupines which had been eaten starting at the belly. A little common sense will show us that the porcupine has to be killed first in order to be turned over; thus, the attack at the unprotected face. When a porcupine gets old and very large, attacks on the face do not quickly weaken it. A few test attacks lets a fisher know that such a big porcupine may be too hard to kill to be worth the effort.

In order to pick up the fisher track again, we make a wide circle around the porcupine den tree and find where the fisher track leaves the porcupine trails. Again the track begins to lead downhill towards a spruce bog. We find another old logging road and decide that three hours of tracking over two miles is enough for one afternoon, and hike back out of the woods on the road. In the back of our minds, though, we think that perhaps if we had followed the fisher a little further we might have found where he caught something to eat. Or we might have found where he curled up in a hole in a tree to rest up a bit before moving on, still hunting. This track has been fairly typical, though, in that we followed the fisher for a fair distance and have found no evidence that he got a good meal. Obviously, the fishers in the Upper Peninsula do get enough to eat, for their population is well established and reproducing itself. This fisher just had to run further to find a meal than we were willing to hike.

FISHERS ARE NATIVE TO NORTH AMERICA and their original species range extended as far south as Georgia in the Appalachian Mountains, southern Illinois in the central forests, and California in the West. They could be found in most of northern North America, where there was an extensive continuous forest canopy. But by the early part of this century, the fisher had vanished from most of its range in the United States. Extensive logging had destroyed the vast forests, and trappers had overharvested their populations to obtain the beautiful and valuable pelts. With such a two-pronged attack, the fisher retreated to Canadian forests, which were less populated and less logged.

Strangely enough, logging also facilitated the return of the fisher to some of its former range. By the 1950s, porcupine populations in Upper Peninsula Michigan had grown so high that they caused significant damage to the timber crop. Porcupines had also become a nuisance at cabins and summer homes where they chewed on such items as ax handles and boat seats to obtain salt. Because the fisher is the only predator which consistently preys on porcupines, the Michigan Department of Natural Resources and the United States Forest Service cooperated to release 61 fishers live-trapped in northern Minnesota in the hope that the fishers would establish themselves, reproduce, and eventually reduce the high porcupine population. Ottawa National Forest proved to be good fisher habitat, and everything desired from the release has occurred. Work done by a colleague and myself shows that fishers reduced the porcupine population to nearly one fourth of its size in the late 1950s and in the early 1960s. Work done by another graduate student appears to show that the porcupines have acquired a healthy reproducing population that is no longer top-heavy with old individuals. Porcupines now appear to be performing a natural function of slowly pruning the forest: killing trees in the forest by eating bark, thus opening small areas of forest to early successional trees. At normal population levels, porcupines help to maintain the diversity of species and ages of trees in the forest.

Although fishers and porcupines have many adaptations which show that they have evolved together as predator and prey, porcupines are not the most important food of fishers in Ottawa National Forest. Fishers eat more snowshoe hares than porcupines and spend much of their time hunting in snowshoe hare habitat. I have found fisher activity patterns to be oriented around hare habitat. For several days in a row, a fisher may stay in a restricted area which is good hare habitat — an area which can be encompassed by a circle about three quarters of a mile in diameter. Then one day the fisher will move perhaps several miles to another area of hare habitat where it will settle down for several more days. While travelling between areas of hare habitat, the fisher will check out porcupine dens and cover much territory, but once back in hare habitat it will seldom move more than about half a mile straight-line distance from one day to the next. During a day a fisher will usually have two or three hunting trips lasting two hours or so apiece; the rest of the time is spent sleeping. While hunting in hare habitat fishers move very slowly, frequently stopping, watching and waiting for hares as they move in and about their hiding places. When a fisher flushes a hare from a hiding place, it quickly attacks the hare. Because it is difficult to discern temporal relationships between fisher and hare tracks left in the snow, it is impossible to calculate how frequently hares flushed by fishers manage to escape. Fishers probably flush many more hares than they are able to catch because a fisher catches a hare only about once every two days. If a fisher is able to catch a hare, it uses the typical neck bite to kill it. Frequently the fisher is unable to bite the hare's neck immediately upon capture, but has to hold the hare with all four feet and juggle it so that a hold on the back of its neck can be secured. Once the hare is held by the back of the neck it takes a very short time to become completely immobilized.

Because male fishers weigh about twice as much as female fishers (10 to 14 pounds for males in Michigan; five pounds for females), males require more food. My work has shown that a male fisher uses up the energy obtained from a snowshoe hare in two to three days, while such a meal will provide energy for a female for three to four days. A porcupine, of course, will last a fisher considerably longer, but considerably more energy is required to capture a porcupine. In order to reduce energy expended to procure food, fishers will consume carrion when they find it. Road-killed and starved deer are eaten by fishers when they can find them; a dead deer will last a fisher for weeks if no other animals find it and help the fisher consume it. I have seen tracks of fishers, coyotes, bobcats, foxes, and weasels all visiting the same deer carcass.

The fisher is slowly reoccupying its former range in many parts of the country. Several northern states have had fisher populations naturally expand and reestablish themselves in areas where they had been exterminated. Other states, like Michigan, have imported live-trapped fishers and released them in former fisher habitat. Most of these releases have been successful and it appears as though fishers can fairly easily reestablish themselves when habitat destruction by man and trapping cease. Biologists will, we hope, be able to study fishers for a long time to come, and will be able to enjoy the beauty of fishers in forests over much of the northern United States. □

"Treasures of Tutankhamun" Dinner-Lecture Series

To provide a richer background for viewing the forthcoming "Treasures of Tutankhamun" exhibit (April 15-August 15), Field Museum is offering its members a Tuesday evening lecture series on topics related to King Tutankhamun's reign and burial. This series, to run concurrently with the exhibit, will be given by internationally known Egyptologists and is free to Museum members. Reservations are necessary and are limited to two per family. Lectures begin promptly at 8:00 p.m. Seating capacity for the lectures, in James Simpson Theatre, is 900.

Also available to Museum members is a dinner to be served before each lecture. Dinner in the Museum's new food service area will be served at 6:00 p.m. and will afford an opportunity for guests to meet the speaker of the evening. A confirmed dinner reservation will automatically reserve a lecture ticket. Dinners are $6.00 each; no refunds will be made. Preference will be given those who request the entire dinner-lecture series. Reservations will be confirmed in order of receipt. Seating capacity for the dining area is 350. Complete information and a reservation form will be mailed to all Field Museum members in the near future. The coupon provided in that mailing should be returned with a self-addressed, stamped envelope. Because of the large number of reservations anticipated, all reservations should be made by mail rather than by phone.

The "Treasures of Tutankhamun" exhibit will be open until 7:30 for Members on April 26 *only*. Please note that the dinner-lecture originally scheduled for April 19 has been rescheduled for April 26.

All lectures will be repeated for the general public on the following Fridays: April 1, 22; May 13; June 10, 24; July 15. Reservations are also necessary for the public lectures and are limited to two per family. Members may, of course, also attend the public lectures.

Lecture #1, March 29

"Discovery of the Tomb"; lecturer: Mme. Christiane Desroches-Noblecourt, Conservateur-en-chef, Department des Antiquites Eqyptiennes, the Louvre; Paris, France

Lecture #2, April 26

"The Amarna Period"; lecturer: Donald B. Redford, professor, Department of Near Eastern studies, University of Toronto; Toronto, Canada

Lecture #3, May 10

"The Reign of Tutankhamun"; lecturer: Klaus Baer, professor of Egyptology, the Oriental Institute of the University of Chicago

Lecture #4, June 7

"X-Raying the Royal Mummies of the Eighteenth Dynasty"; lecturer: James Harris, chairman of the School of Dentistry, the University of Michigan; Ann Arbor, Michigan

Lecture #5, June 21

"Daily Life in Ancient Egypt"—with special emphasis on the eighteenth dynasty and Tutankhamun; lecturer: Nora Scott, curator emeritus, Department of Egyptian Art, Metropolitan Museum of Art, New York

Lecture #6, July 12

"The Decorative Arts of Egypt from the Royal Collections"; lecturer: John Cooney, research curator, Department of Ancient Art, the Cleveland Museum of Art

Letters from Antarctica, 1976-77

Edward Olsen, chairman of the Department of Geology and curator of mineralogy, left Chicago early in December to spend three months searching for meteorites in Antarctica. The following, dated December 7, is the first of a series of reports expected from Olsen as his work there progresses.

It all began in the summer of 1975, when I first heard about the Yamato Mountains meteorites, all thousand of them! Until then the number of known, distinct meteorites—representing all the collecting done by mankind over the centuries—was around 1,900. Although some 70 million meteoric objects impact the earth's atmosphere *each day*, fewer than about 500 make it through to the surface of the earth *each year.* Of course, two-thirds of those fall in the oceans, because two-thirds of the earth is covered with water. That leaves about 160 to 165 potentially to be found on land. But, in spite of the fact the earth is crowded with people, a great deal of the land surface is unoccupied—the mountains, the deserts, the tundras—because mankind occurs in concentrated population centers. So, the chances for recovery are slim. On top of that, over much of the land area of the earth there are rainy times, snowy times, heat alternating with cold, soils that contain acids from plant and leaf decay—all factors that cause the average meteorite to weather away rapidly. When all is considered, 1,900 meteorites recovered isn't bad. Then the Yamato Mountains discoveries came along.

Back in 1969 a team of Japanese geologists, working in the region of the Yamato Mountains in Antarctica (on older maps they were called the Queen Fabiola Mountains), came across nine small meteorites that were just simply sitting out on the surface of glacial ice. The following year, during the Antarctic summer which runs from November through about mid-February, they returned to the area and recovered 560 more! Subsequent summer searches have turned up about 400 more, bringing the total to almost 1,000.

It could be that these are a thousand fragments of a single meteorite that crashed onto the rock-hard ice. But no—of the dozen or so that have been studied to some extent, there are at least six different kinds. Assuming, when they are all studied, that at least several hundred are distinctly different falls (and perhaps all thousand are), the high concentration in a geographically small area (only 18 square miles) is a puzzle for which there is no good explanation at the present time.

Speculation, however, runs something like this: If meteorites, landing on the polar ice cap in Antarctica over a long time (like hundreds of thousands of years), are gradually buried under successive layers of ice accumulation, they are effectively in cold storage. They are not rained on; they are not oxidized away; they suffer no soil acids. The polar ice moves downhill, as we know it does, like a painfully slow river. If it runs up against a mountain barrier it gets warped upward. Strong winter winds, carrying ice particles, abrade the ice surface, and the upturning end gradually is abraded away, leaving behind, frozen into it, any material that can't be moved by the wind.

Thus, meteorites that fell over eons of time, over the wide area of the polar cap, are exposed by the combination of ice movement, warping, and abrasion. This seems to be the only explanation so far that fits. If that can happen in one place in Antarctica, it could have happened again elsewhere there.

Meteorites are the only tangible objects we have from space other than the returned lunar samples. The meteorites we know come from a variety of planetary objects representing a number of conditions. From meteorites we have been able to tell the age of the solar system, to tell whether the sun was more active or less active billions of years ago than it is now, to tell the chemical history of the solar system, of comets, and of possible planets beyond our solar system, and to tell how biological activity came to be in the solar system and the chances of it occurring elsewhere in the universe. Meteorites are generally homely objects—but packed with information when you know how to wheedle answers out of them.

I've been "wheedling" meteorites for almost 15 years. I have also harbored a secret desire to go to that mysterious continent Antarctica, for as many years. It is clearly the last place in the world where one can carry off a truly primitive *expedition*, in the 19th-century sense of that word. Until the Yamato meteorites there was no excuse for me to go. When I saw my chance, however, I lunged at at. It could be the last real adventure in an old man's life!

In the summer of '75 I decided to put together a proposal to the U.S. Antarctic Research Program (USARP) to go down for a field search, and try to duplicate the Japanese finds—or, if not that, to demonstrate that the Japanese finds represent a special case, one that cannot easily be duplicated anywhere else. In the process of getting together a proposal I discovered that Dr. William Cassidy of the University of Pittsburgh had already submitted one. Since I was too late, by a few months, I decided the only way to get in on it was to see if I could join him. I could offer experienced eyes. So it was that I became part of the search effort.

Antarctica is a strange and mysterious place. It straddles the South Pole, is half again larger than the United States, and, over the whole continent, the *average temperature* never gets above freezing. This doesn't mean, of course, that it never gets above freezing on some days. Along its northern coasts and valleys, and for some distance inland odd days may have temperatures in the 50s during the summer. In the winter, however, it's the coldest place on earth. Several years ago the Russian station, Vostok, recorded a low of 127°F below zero!

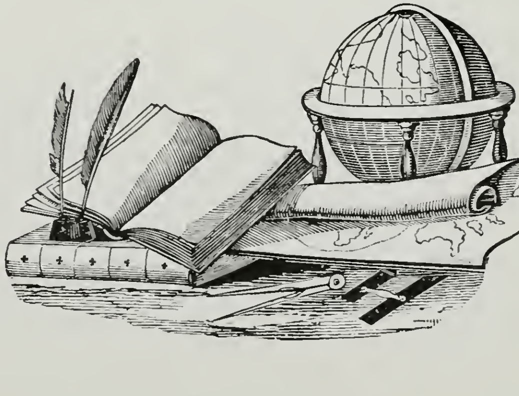
Getting to Antarctica isn't easy. After receiving approval from the National Science Foundation's Office of Polar Operations, you have to take a thorough physical examination. I took mine at the Naval Hospital at Great Lakes Naval Station just north of Lake Forest. If you aren't in good condition you don't go. After passing the physical you go to a four-day orientation session, held either in Virginia or Arizona. In the sessions you find out the logistics of getting yourself and your gear down to the main U.S. station at McMurdo Sound. You also find out all the details of clothing, living conditions, aircraft and field safety and the restrictions on the kinds of activities you can perform. One of the first things they hand you at the sessions is a book entitled "Survival in Antarctica." It's your first stunning jolt—this isn't just another field trip. Everyone gets a little scared at this point.

Once back home you begin the laborious process of getting together the bits and pieces of personal equipment and clothing. The USARP people supply you with all the cold weather clothing, but some items you want to pick out personally.

Finally the day comes. I left Chicago in a snowstorm (how *a propos*) and flew to Los Angeles. From there a Navy bus met all Antarctic arrivals and drove us to the Naval Air Station at Point Mugu, near Oxnard, California. The bus traveled along lovely California Route 1, that runs along the coast and gives good views of surf and rock and mountains. After checking in at the Naval Base, about 80 individuals—biologists, geologists, meteorologists, physicists, and some military personnel—boarded an Air Force C-141. It's a strange looking plane. The wings are attached at the top of the body, rather than below, and they droop towards the ground. It has the appearance of a giant moth. When you get inside two things strike you; the seats face to the rear, and there are no passenger windows! Also, there is no interior finishing, so the bare metal walls line the cabin; pipes, conduits, valves, gauges, and all the hardware that is normally hidden in commercial planes is sticking out. When the engines start the roar is deafening. An air force man walks down the aisle and issues ear plugs, which you're only too happy to use. Overhead a single row of lights illuminate the cabin, and are none too bright for reading. The flight goes smoothly from Pt. Mugu, to Hickam Field Air Force Base near Pearl Harbor, Hawaii. After a stop of several hours you take off and arrive at an Air Force field near Pago Pago in American Samoa.

Finally, after refueling, we left there and flew to Christchurch, on the South island of New Zealand. There we spent three days, adjusting to the time differential and getting outfitted with cold weather clothing—parka, fur hat, several kinds of mittens and gloves, thermal underwear and socks, thermal underwear and socks, thermal boots, woolen shirts, and on and on. No one is going to freeze. All this is done in the 80°F heat of the New Zealand summer, which starts in November and is quite warm by early December when we arrived.

Christchurch is like a little bit of England, with bright red buses, right-hand cars drive on the left side of the street, and the rather British accents of the people. It is located on a low, fertile plain, and to the east stands a snowcapped range of ruggedly beautiful mountains, the Southern Alps. From Christchurch we fly to McMurdo Sound in Antarctica. That will be covered in the next letter.



Books

Legion of Night: The Underwing Moths, *by Theodore D. Sargent. University of Massachusetts Press, Amherst, Mass.; 222 pp.; $15.00. (Available at Field Museum Shop; 10% discount for members.)*

A VERY SPECIAL CLASS of natural history books are those which qualify as technically thorough and authoritative—thus of interest to the specialist, yet are accessible and stimulating to the general reader. Sargent's *Legion of Night*, a comprehensive study of moths belonging to a single genus, is a superb example of this select category. The book is an in-depth treatment of the genus *Catocala* occurring in eastern North America.

Commonly known as the "underwings" for their characteristically showy lower pair of wings, the *Catocala* may indeed be regarded as arcane subject matter, and of real interest only to lepidopterists whose particular fancy is moths. But among the moths, the underwings rank along with the silk moths (saturniids) and hawkmoths (sphingids) as the most attractive to many collectors.

Sargent's text includes detailed descriptions of 71 species and color plates of each, and there is a respectable abundance of charts, graphs, and tables based on the author's observational data. But the book is in no sense a monograph or taxonomic treatise; several chapters deal individually with the behavior of moths toward artificial light; how to attract underwings with bait; their courtship behavior; and the various ways in which the moths feed, develop, and transform from egg to caterpillar to pupa to moth. Sections on coloration differences within species, and how and why birds attack underwings offer fascinating fare even for readers whose knowledge of biology is slight.

In the delightful chapter "Of Men and Names" Sargent discloses some of the curious history of scientifically naming and describing underwing moths in the early literature:

In the flurry of naming the *Catocala* during the late nineteenth century, the tendency was to attach a name to every apparently new specimen that came to hand, hoping that time would prove the name worthy of species rank. Accordingly, many forms were originally described as new species: (e.g. "sinuosa," a form of *coccinata*; "gisela," a form of *micronympha*; "aholah," a form of *similis*). In this same vein, there was a tendency to attach new names to very minor variants (e.g., "moderna," a small *maestosa*), and this practice led to the rather embarassing situation of females being described as new forms (e.g., "basalis," the female of *habilis*; "curvata," the female of *robinsoni*; "hinda," the female of *innubens*).

With all this activity, it was inevitable that some species would be described by two or more authors, thereby creating synonyms. The decision as to which name should stand in such a circumstance is based upon the rule of priority (i.e., which name was published first). This rule is ordinarily, and in principle, easy to apply. But given the competitive furor of the times and the personalities involved, considerable controversy did arise, and the ensuing disputes were often heated.

Perhaps the flavor and personalities of that era can best be recalled through excerpts from the writings of some of the principals. For example, the Reverend George D. Hulst in a paper entitled "Remarks Upon the Genus CATOCALA, with a Catalogue of Species and Accompanying Notes" (1880), observed in his introductory comments:

> *It is very certain that full knowledge will largely reduce the so-called species. By the necessities of the case, species are at first very largely multiplied. They are very generally based upon a single specimen, often faded, rubbed, or mutilated....*

This paper was not received with equanimity by A. R. Grote, as the following response makes clear:

> *The publication of a paper on the species of* Catocala, *by a clergyman, the Rev. Mr. Geo. D. Hulst . . . obliges me to notice its contents briefly. The criticism that I make on this paper is, that its publication was entirely unnecessary from a scientific point of view....*
>
> *In a somewhat lengthy preamble, in which I find nothing original which is at the same time important, Mr. Hulst likens the present knowledge of the species of* Catocala *to a diseased infancy. In this Mr. Hulst confounds the state of his own mind on the subject with that of others....*

Actually, what really incited Grote's wrath became clear when Hulst sided with Herman Strecker* in one of the interminable conflicts between him and Grote:

> *We are sorry in our service of science to be compelled to judge between Messrs. Strecker and Grote in a matter which has been so prolific of ill-feeling between them. Both claim priority in the naming of three species of Catocalae. Attempting to get at the truth, irrespective of personal feeling toward either of these gentlemen, to both of whom we are under obligation for favors, we give our judgment in favor of the names of Mr. Strecker....*

Grote's views on Strecker are abundantly clear:

> *Mr. Strecker's work is, on the whole, of such an indifferent character that I am unwilling to criticize it. He has made proportionately more and more unexcusable synonyms than any other writer, and his slovenly descriptions and confessed unacquaintance with structure place him on a level with the worst amateur who has "coined" a "species." In vulgarity and misrepresentation he is, fortunately, with a rival....*

Strecker was rarely bested in these matters. He had previously reviewed Grote's "Check List of North American Noctuidae, Part I" (1875), and concluded his brief statement as follows:

> *The whole thing is scarcely worth the time devoted to this review, but as the advertisement would lead us to expect quite a different production, than that really furnished, we have given this cursory warning because the price demanded is entirely too big to pay for trunk paper....*

To return to the situation referred to by Hulst, the question at issue concerned the dates of publication of Grote's descriptions of *C. anna, adoptiva,* and *levettei,* and Strecker's descriptions of these same species as *C. amestris, delilah,* and *judith.* An accusation of antedating was made:

> *With regard to the species re-described by Mr. Strecker under the date of "August," whereas the publication was not received until November 12, I have shown that Mr. Strecker placed a false date, and have exposed his motive for doing so....*

In this particular case, most scholars now agree that Grote had his names first in manuscript, but that Strecker's were published first and so have priority. In fairness, however, it must be noted that questions regarding Strecker's methods were not completely unreasonable....

No doubt the day of lively controversy over the matter of names has passed by — certainly the luxury of such personal and polemical writing is rarely countenanced in today's scientific journals.

**Herman F. Strecker (1836-1901), of Reading, Pennsylvania, was one of the great lepidopterists of his time. In 1908 Field Museum acquired the Strecker collection, numbering more than 50,000 specimens. See "The Sculptor Who Collected Butterflies," in the January, 1975*, Bulletin.

Edward E. Ayer Film Lecture Series

March and April, 1977

Saturdays, 2:30 p.m.

This season's film lectures are to be held in the renovated and recently opened James Simpson Theatre, whose entrance is conveniently located just inside the Museum's west entrance. This is of special interest to the handicapped, for the new west entrance is now at ground level and all steps between curbside and theatre have been eliminated. The west entrance also provides free admission to the theatre. Access to other Museum areas, however, requires the regular admission fee (except on Fridays) or membership identification. Plan to have dinner in the Museum's new dining area before attending the lectures.

March 5

ARIZONA'S DESERT WONDERS

Presented by Arthur Twomey

Discover the Sonoran Desert, a unique environment that supports a variety of plant and animal life. The giant saguaro cactus and the colorful, deadly gila monster are among the many startling phenomena living in this desert wilderness.

March 12

LAND AND SEA ADVENTURES

Presented by William Sylvester

Follow the voyage of a freighter as it journeys from New York City to the Adriatic, stopping at exotic ports along the way: Casablanca, Genoa, Venice, the Yugoslavian Riviera; then on to the spectacular Alps by car.

March 19

ROYAL LONDON

Presented by Doug Jones

The city of London is vibrant with history; trace its development through visits to famous landmarks across the city.

March 26

THE HUICHOL: PEOPLE OF THE SACRED CACTUS

Presented by Kal Muller

Lost in time in their rugged Sierra Madre sanctuary, the Huichol Indians of Mexico still live by their pre-Columbian beliefs. Daily activities as well as major rituals are captured on film.

April 2

THE ANDES

Presented by Thayer Soule

Travel the full 4,000-mile length of the Andes—from Venezuela to Patagonia; see archaeological sites, colorful markets, and remote corners—an intriguing close-up of the Andes range.

April 9

THE REAL YELLOWSTONE

Presented by Fran William Hall

Explore Yellowstone out of season as well as in season and venture where the car does not go; an eloquent presentation of majestic summer and winter moods.

April 16

CHAMBERS OF THE SEA

Presented by Stanton Waterman

An award-winning underwater photographer introduces us to the Sinai reefs in the Red Sea and to remote atolls in the Indian Sea—areas rich in colorful, exciting marine life.

April 23

AMERICA'S HEARTLAND

Presented by Walter Berlet

From the Gulf of Mexico to Minnesota, the Mississippi River is home to a diversity of wildlife and is testimony to early western settlement. The beauty of the river is more significant than the myths and tales it has inspired.

April 30

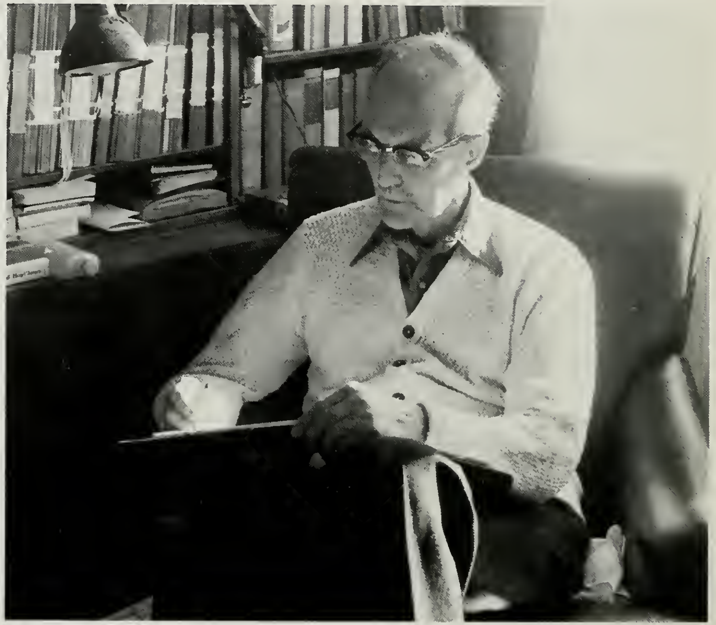
BIRDS OF PREY

Presented by Alan Degen and Neil Rettig

Two raptors, the great horned owl and the red-tailed hawk, are common to the Chicago area. Wildlife specialist Degen and well known photographer Rettig join forces in presenting unique sequences of hawk eggs hatching, nesting cycles, and prey-predator relationships.

field briefs

James Marvin Weller, 1899-1976



James Marvin Weller in his study

James Marvin Weller, a field associate of Field Museum since 1963, was born on August 1, 1899, to Stuart and Harriet Weller. His interest in geology was well defined when he was still a young boy, as he joined his father, a University of Chicago invertebrate paleontologist, on field trips to the Missouri Ozarks. All of his undergraduate and graduate work in geology was done at the University of Chicago, where he received his B.S. (1923) and Ph.D. (1927).

Weller's first formal employment—while still a high school student—was as an assistant geologist, for four summers, with the Illinois State Geological Survey. During this period he mapped the Carboniferous rocks of Illinois. From 1920 to 1922 Weller took time out from college to work in India as an exploration geologist for a British oil company. In 1923 he married Phyllis Vincent Gothwaite, a childhood sweetheart.

In 1925 Weller's career as a survey geologist resumed as he rejoined the Illinois State Geological Survey, remaining there for twenty years. In 1936 and 1937, while still with the Survey, Weller was appointed assistant professor of geology at the University of Illinois. The Survey period was a prolific one for Weller, as he produced more than 90 technical articles. His work at that time was divided equally between stratigraphy (the study of rock strata) and paleontology, and his more important papers in stratigraphy dealt with cyclic deposition; his classic deciphering of the complexities of the coal cycle—which he called cyclothems—also appeared then and he wrote on sponges, crinoids, brachiopods, snails, and his special interest—trilobites.

He left the Illinois Survey as head of stratigraphy and paleontology in 1945 to return to the University of Chicago, where he was named professor of invertebrate paleontology and director of the Walker Museum of Paleontology. He spent 1952 to 1954 in the Philippines with the U.S. Geological Survey, searching for coal deposits.

Weller retired in 1965; in 1971, with the onset of ill health, he and his wife moved from Chicago to the milder climate of California. There, on July 21, 1976, he died. Weller is survived by his wife, his daughter Harriet, and a brother, Professor Allan Weller, of the University of Illinois.

Weller held membership in a number of academic and professional societies, including Phi Beta Kappa and Sigma Xi, which he served as president in 1950-51. He was an honorary member of the Society of Economic Geologists, which he also served as president. He was also editor of the *Journal of Paleontology* and the *Journal of Geology*, and was a member of the Commission of Stratigraphic Paleontology.

His technical papers number more than 160, many of which have been translated into foreign languages, including Russian. His books include *The Geology of Edmonson County* (his doctoral dissertation, published in 1927), *Stratigraphic Principles and Practice* (1960), and *The Course of Evolution* (1969), which synthesized the existing knowledge of fossil plants and animals. The latter two works, still in print, are classic textbooks.

Weller's life work, his teaching, and writings have contributed immeasurably to our understanding of the geology of Illinois and neighboring regions, and his association with Field Museum is one that will be permanently cherished by his former colleagues in the Department of Geology.

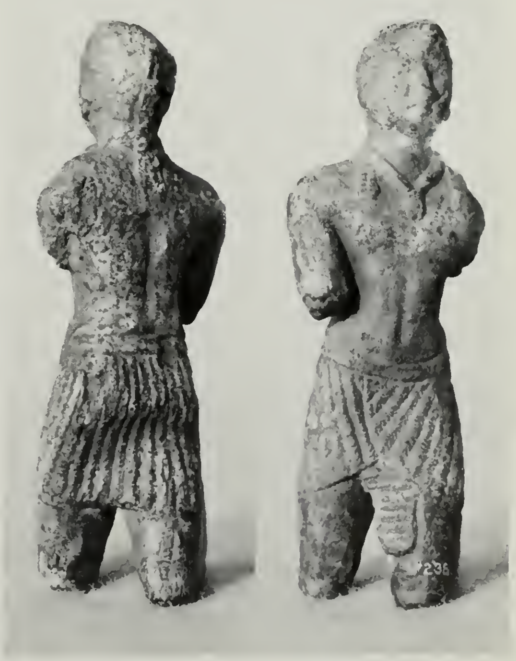
—Matthew H. Nitecki
Curator of Fossil Invertebrates

A Kushite King—in Bronze

For close to 100 years, beginning early in the eighth century, B.C., pharaohs from the Sudan ruled ancient Egypt. The Sudan bordered Egypt on the south and was known as Kush; those ancient Sudanese kings are known today as Kushites and the era during which they ruled Egypt is called the Kushite Period or Kushite Dynasties. Within the scheme of Egypt's ruling families, the period is designated Dynasty XXV. This time of Kushite domination was for the most part characterized by a continuation of Egyptian ideas in art and religion rather than by new ideas entering Egypt from an outside source.

A recent publication by Edna R. Russmann, *The Representations of the Kings in the XXV Dynasty* (Bruxelles-Brooklyn, 1974), is concerned with the surviving examples of royal figures from this period. A small bronze statuette of a Kushite ruler in the Field Museum collection can now be added to the list of known sculptures of these Dynasty XXV rulers. Although the statuette is uninscribed there is no doubt about its date, for the figure is adorned with a characteristic pendant necklace; and this is worn in the style typical for that period: the ends of the suspension cord are brought forward over the shoulders. The central element of the necklace is often a ram's head emblematic of the Egyptian god Amun, but unfortunately, the crudeness of this figure's casting and the wear on its surfaces makes definite identification of the pendant impossible. One may interpret the raised areas on the forehead of this statuette as the remains of the bases of two uraei (sacred serpents) which originally projected from the front of the head; at the back there is a curious raised area. Together, these prominences may be viewed as a combination of the close-fitting cap with uraeus and a supporting base for a crown or as tails of the uraei descending to the shoulders. The pose of this statuette corresponds to two other known bronze figures of this period; one is in the Museum of Fine Arts, Boston, and the other is in the Hermitage Museum, Leningrad.

—Earl L. Ertman
Department of Art
The University of Akron



Bronze statuette of Kushite ruler, front and back views. Height: 10 cm. Cat. No. 17238.

Staff Notes

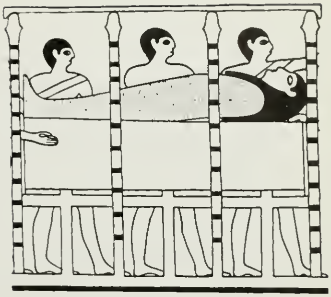
Kenneth John Grabowski has joined the library staff as library assistant. He holds a BA in psychology from Northeastern Illinois University and is completing work toward an MS in biology.

John Terrell, who joined the Field Museum anthropology staff in 1971, has been promoted to associate curator, oceanic archaeology and ethnology. Bennet Bronson, who also joined the anthropology staff in 1971, has been named associate curator, Asian archaeology and ethnology.

Luis de la Torre, curator of mammals, has resigned from that post, which he had held since 1971. As research associate de la Torre will continue to be affiliated with the Museum.

Harriet Smith, lecturer in the Raymond Foundation since 1947, has retired.

Mummies Booklet Revised



Of special interest to those who want to bone up on their Egyptology prior to the opening of the "Treasures of Tutankhamun" exhibit, opening April 15, is the newly revised *Mummies*, now available at the Field Museum Shops for $1.50; it may also be ordered, postpaid, from the Division of Publications. The profusely illustrated booklet was written by Richard A. Martin, late curator of Near Eastern archaeology, and has been revised by David P. Silverman, project Egyptologist for the Tutankhamun exhibit. A new bibliography has been added.

February at Field Museum

LAST CHANCE TO SEE

I Wear the Morning Star—thru Feb. 6. Exhibit of garments designed by Western Plains Indians for the Ghost Dance, a pacifistic religious movement born of one man's impressive visions and adopted by 30 tribes in the late 19th century. Hall 9.

SPECIAL EXHIBITS

The Place for Wonder. Visit the newly opened *The Place for Wonder* gallery. Open to visitors of all ages, this room provides a "hands-on" approach to numerous natural history specimens and artifacts. The gallery is staffed by museum volunteers and is open to the public promptly: weekdays, 1 p.m. and 2 p.m.; weekends, 10 a.m., 11 a.m., 1 p.m., and 2 p.m. Located near the new cafeteria, ground floor.

Male and Female: Anthropology Game. This game/exhibit of 38 artifacts is a great way to learn that economic and social roles of the sexes are not universally the same. South Lounge, 2nd floor. No closing date.

Man in His Environment. This exhibit takes a global view of some of the most serious environmental problems confronting all mankind and asks visitors to involve themselves in these problems —and the need for solution. Hall 18. No closing date.

Pterosaur. A stylized model of the largest known flying creature —an extinct pterosaur—dramatizes a special exhibit of pterosaur fossils. Northwest Gallery, 2nd floor. No closing date.

SPECIAL PROGRAMS

Discovery Programs. Saturdays and Sundays, 10 a.m. to 3 p.m.: take tours, follow demonstrations, participate in museum-related activities.

Winter Journey for Children: *All that Glitters.* Self-guided tour begins in the geology halls and ends in the gem room with its display of gold and silver. All children who can read and write are invited to participate; families will enjoy it too. Journey sheets are available at the information booth.

The Ancient Art of Weaving. Members of the North Shore Weavers' Guild demonstrate weaving and spinning every Monday, Wednesday, and Friday, 10 a.m. to 12 p.m. South Lounge, 2nd floor.

SPECIAL-INTEREST MEETINGS OPEN TO THE PUBLIC

Feb. 1, 7:30 p.m.	*Kennicott Club*
Feb. 4, 8:00 p.m.	*Chicago Anthropological Society*
Feb. 8, 7:30 p.m.	*Chicago Nature Camera Club*
Feb. 9, 7:00 p.m.	*Chicago Ornithological Society*
7:30 p.m.	*Windy City Grotto, National Speleological Society*
Feb. 10, 8:00 p.m.	*Chicago Mountaineering Club*
Feb. 13, 2:00 p.m.	*Chicago Shell Club*
Feb. 15, 7:30 p.m.	*Chicago Audubon Society*

COMING IN MARCH

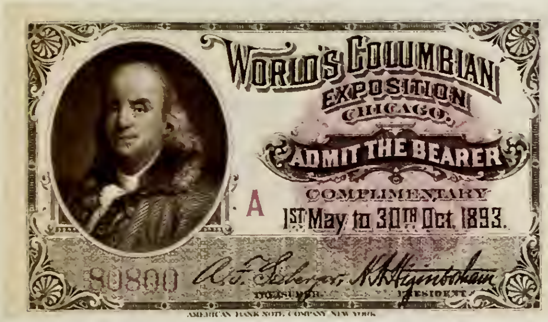
On Fridays at 2:30 p.m. (March 5 through April 30) the museum offers its popular Ayer film/lecture series. The March 5 lecture is entitled *Arizona.* All lectures are in Simpson Theatre, ground floor.

FEBRUARY HOURS

The Museum Opens daily at 9 a.m., closes at 4 p.m. weekdays and 5 p.m. weekends. On Fridays, year-round, the museum is open to 9 p.m. Food service areas open daily at 9 a.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday (closed Feb. 21). Obtain pass at reception desk, main floor north.

Museum Telephone: 922-9410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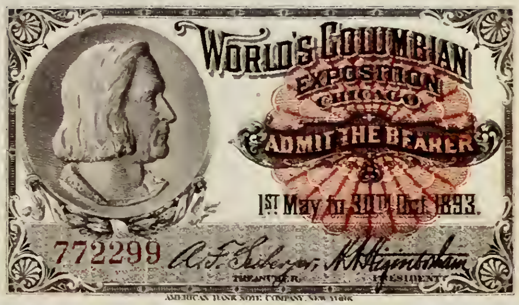
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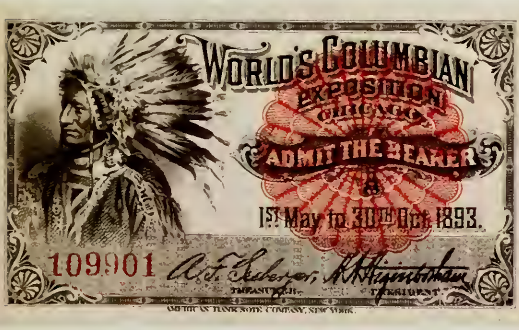
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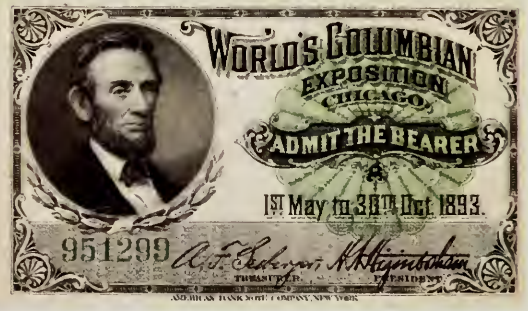
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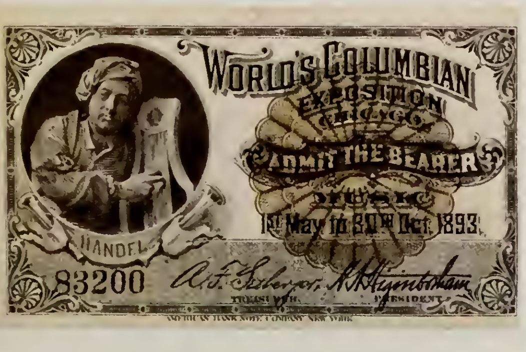
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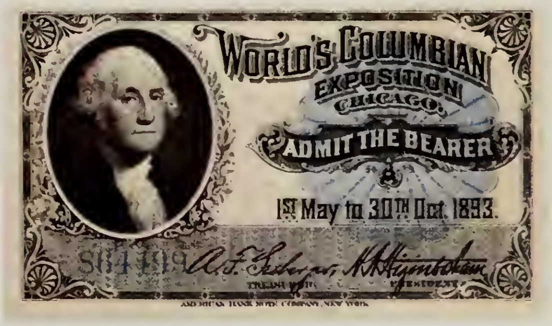
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President and Director: **E. Leland Webber**

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CONTENTS

3 **Animals Are Human, Too**
(Or Are Men Just Little Calculators?)
By John Terrell, associate curator of Oceanic archaeology and ethnology

6 **Kimberley Snail Hunt—Round One**
By Alan Solem, curator of invertebrates

10 **Waterways of Ancient Peru**
By Michael Moseley, associate curator of Middle and South American archaeology and ethnology

16 **Letters from Antarctica, 1976-77**
By Edward Olsen, curator of mineralogy

18 **Field Briefs**

back cover **March and April at Field Museum**
Calendar of coming events

COVER

Six beautifully engraved tickets to the World's Columbian Exposition of 1893 from a set donated to Field Museum library by Miss Dorothy Rea of Richmond, Missouri. The set had been given to Miss Rea by Harlow N. Higinbotham, President of the Exposition. Mr. Higinbotham served as the second president of the board of trustees of Field Museum and was among the earliest donors to the library. He purchased and donated the Kunz Collection of books on geology, mineralogy, and gemmology, a collection that contains many rare works on these subjects.

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Animals Are Human, Too

(Or Are Men Just Little Calculators?)

By John Terrell

A surprising number of biologists and social scientists these days are quarreling about an issue in psychology that must seem astonishingly simple-minded to anybody who owns a dog or cat, or to any parent who has raised a child through puberty to adulthood. What some of my colleagues are calling "The Great Scientific Debate of the 20th Century" is astounding because it often sounds like a repeat of the controversy set off in 1858 when Charles Darwin and Alfred Wallace shocked Victorian society by announcing their discovery of the theory of evolution by means of natural selection.

What is this 20th century fracas in the lofty world of science all about? Putting it simply, the issue is this one: *How like an animal is Man?* How much of human nature is dictated by our biology, by our animal nature? How extensively are human beings really governed by wisdom and social custom? Or are we, like other animals, driven deep down inside by instincts, blind passions, and ancient biochemical urges?

Until 1975, when Edward O. Wilson, a brilliant zoologist at Harvard, published a monumental book called *Sociobiology: The New Synthesis*, most social scientists and probably most biologists thought this Victorian issue touched off by Darwin and Wallace had long ago been put to rest. Conventional wisdom has taught for years that the human species is uniquely different from all other animal species. Fifteen years ago when I was an undergraduate studying anthropology at Harvard it was explained to me by my professors that evolution had given us a brain which was so large and powerful that the human species had been freed by evolution from the rigid grip of biological predestination. I was told that human beings ruled themselves culturally, not biologically. While my psychology teachers avoided the word like the plague, it was pretty clear, too, that animal behavior was different from human behavior because animals were controlled by something called *instincts*. If herring gulls, for example, were presented with a certain kind of stimulus, they had to behave in a fixed, stereotyped fashion. Somehow their behavior was in their genes and was passed down from one generation of gulls to the next by sexual reproduction.

What Wilson and other sociobiologists are trying to do is challenge the smug notion that man is innately different from other animals. These scientists are saying, in effect, that human beings are more animal than most of us care to admit. They define sociobiology as the systematic study of the biological basis of all social behavior. They claim that it is high time biologists began studying the biological foundations for human social behavior, too.

Many people—not just biologists and social scientists—believe that the human species is unique. It is not surprising that Wilson and other sociobiologists are being accused so widely of trying to destroy the dignity of mankind.

The trouble with Wilson and his colleagues, however, is they are taking matters too far in one direction. They are right when they insist that human beings are animals. But they seem afraid to admit that animals are human, too.

The late British biologist C. H. Waddington in a review of *Sociobiology: The New Synthesis* published in the *New York Review of Books* back in August 1975 had this to say:

> *Is it not surprising that in a book of 700 large pages about social behavior there is no explicit mention whatever of mentality? In the index, covering more than thirty pages of three columns each, there is no mention of mind, mentality, purpose, goal, aim, or any word of similar connotation.*

He went on to add that something very similar to mind or purpose is often implied in Wilson's text (I would

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myself point to Wilson's discussions, for instance, on learning and socialization). But he concluded that Wilson's failure to deal forthrightly with animal mentality is the weakest feature in the whole grand structure he has built for sociobiology. If sociobiologists are going to include human beings within their field of research, they have got to deal with the role played by goals, aims, purposes, and the total nature of experience felt both by mankind and by "lesser" animal species.

I suspect anyone who has a dog or cat knows exactly what Waddington was talking about. Nearly every pet owner can relate countless stories about how Rover or Zenobia is so human. While pet fanciers are liable to give their animals too much credit for being human, pets are often incredibly adept at manipulating their loving masters for their own pet purposes. Animals really can be more capable of conscious mental activity than some people give them credit for being.

On the other side of the fence, however, Wilson's critics have taken matters too far in the opposite direction. Wilson is obviously right in saying that people have not gotten away entirely from being animals. Ask any parent with a child old enough to have passed through most of the stages of childhood and adolescence. You don't have to tell *them* that biological changes during growth and maturation get involved in how children act. They know it all too well.

Many parents have also experienced an uncanny thing. Little Lucy or young Johnny—perhaps only for a year or two—reminded everybody of Aunt Mary or Uncle George who died years ago, long before Lucy or Johnny was born. Why? While it is true that, just like pet owners, parents are notorious for exaggeration when it comes to the kids, is it not possible for human beings to inherit some kinds of behavioral characteristics? Dog breeders can control selectively for the inheritance of some behavior traits in dogs. Is human behavior entirely divorced from biological inheritance?

It may surprise you to learn that scientists aren't doing a very effective job of answering questions like these. But it is important to understand why it is so difficult to come up with answers. To be sympathetic to the scientist's plight, you need to know how evolution can operate to make animals more intelligent over the course of millions of years. Seeing how difficult the job is for nature to perform suggests why human beings are unique in the animal world in being as flexibly adaptable and clever as they are. Evolution is the reason why we are such an uncommon kind of animal.

How to make a better thinking machine

The easiest way to imagine how hard evolution has to work to make animals brighter over countless generations is to forget at first about animals. We humans are too prejudiced by our sense of superiority to give them a square deal. Think instead about little calculators like the one you can buy to add up your purchases at supermarket.

Why do the companies that make these calculators hire people to make better machines? Not because they like change for its own sake. If a calculator company has been making good, dependable, efficient, and economical machines for a long time, it isn't going to change its product fundamentally unless it has to do so. And when is that? When someone in top management has sensed that people are not buying as many company calculators as they used to. If there is any change in the needs, wants, and tastes of the consumer, a company had better follow suit or it will end up bankrupt. When a company neglects to keep pace with the market, it's a sure bet that some competitor will step in and take over. In short, companies (and evolution) don't play around with a good thing until it looks like it isn't such a good thing any more. Machines aren't changed, and animal species don't evolve in the direction of greater intelligence, unless there is good reason to do so.

In addition, few companies and no animal species try to do everything. A company may want to be No. 1 in some part of the market, but not in all parts. It's too much work and it costs too much to try to be best in everything you do. In the calculator business, for example, manufacturers of little calculators don't try to compete with General Motors. They make mini's and leave cars to the auto makers.

This second point brings me to the conclusion of my story. There are all sorts of ways you can design a mini-calculator. Separate designs sell best in different markets. Most people, for instance, may only want a fairly simple machine to take to the food market; they would be wasting their money if they bought a mini-calculator that did more than add, subtract, multiply, and divide. The mechanism of such a simple calculator is quite basic. The buttons you push on its face activate it to perform standard functions, like adding and dividing. The ability for a mini-calculator to do something at the touch of a button is created during manufacturing by "hard-wiring" in a fixed set of things to do when each button is pushed. Hard-wired functions can't be changed. Push the appropriate button and the machine has to do what it has been fixed to do. In short, hard-wired functions such as adding and subtracting are a calculator's "instincts."

While most people may only want a fairly simple calculator to do basic arithmetic, brainy mathematicians may want to buy more sophisticated calculators that can do all sorts of difficult mathematical formulas. Since it would be very expensive to make machines with separate buttons to do every possible calculation that a brilliant mathematician might want to do, it is a wise idea to sell these scholars special calculators which are intelligent enough to learn how to do complex things when shown

how to do them. The ability for calculators to learn how to do something is called "programmability."

While companies make mini-calculators that can't learn anything and which operate entirely by hard-wired "instincts," no company makes a little machine which has to be taught everything from scratch—i.e., completely programmed—every time you turn it on. Really sophisticated calculators are made with a combination of hard-wired functions, like adding and dividing, *and* programmability. Jobs that must be done over and over again by anyone using even a "bright" calculator are hard-wired. Peculiar jobs that aren't done very often are left up to the user to program when needed.

How nature makes a better animal

It may be evident how this discussion of calculators translates into biological terms. The "companies" equal particular species to which different kinds of animals belong. The consumer market is the same thing, more or less, as the natural world to which all species must adapt if they are to survive. The designer is the creative force of evolution. The calculators are, of course, animal brains with different levels of intelligence.

A clam or an oyster is like a fairly simple calculator made to be taken to the supermarket. A dog or a cat is like a sophisticated machine that does simple tasks at the touch of a button, because of hard-wired instincts, and also complex tasks, such as rolling over and playing dead or manipulating its owner, because of hard-wired basic functions and a lot of programmed learning. People, in keeping with such an analogy, are even more sophisticated calculators than dogs and cats. And like all intelligent animals, people are like calculators with extensive memory stores so that they can learn a lot of things.

It may be clear why evolution took so many millions of years to come up with the human species. We are extremely complex organisms. We are expensive for nature to manufacture, because we use a lot of materials and food energy, we are intricate to assemble, and we take a long time to mature. In truth, we may not even be all that durable or dependable once we have been assembled. But—and this is what matters—once evolution got to the point where it was useful and feasible to invest so heavily in intelligence, we proved to be an exceptionally flexible animal which could perform all kinds of tasks and which could solve all kinds of problems, from simple to sophisticated, because of our remarkable program learning ability.

So we're all sort of human

It's not difficult so see why many people find the Great Scientific Debate of the 20th Century a little simpleminded. The sociobiologists are looking for the genetically-inherited, "hard-wired," biologically-controlled behavior patterns which undoubtedly exist in every species of animal. Even in human beings. But when they are talking about intelligent species including the human species, I am tempted to ask them: So what?

Of course our species is not entirely different from the rest of the animal world. But we are an immensely complex, incredibly "programmable" kind of animal. Our human nature may not be entirely free from our basic biological hard-wiring, but what difference does that make? This 20th century debate seems to be a quibble over nothing important.

Sociobiologists would retort that we are really terribly ignorant about how much hard-wiring there is in our species. That we surely are. But I'd like to take the side of the other animals. As Donald R. Griffin of Rockefeller University wrote recently in the *American Scientist*:

> *Only extreme skeptics deny the reality of human mental experiences, such as images of objects and events that may be remote in time and space from the immediate flux of sensations. But the possibility that something similar might occur in animals has been subject to such an effective taboo that, for half a century, the question has been strenuously evaded. Recent advances in ethnology call into question the rigidity of these inhibitions and suggest that it may be time to reopen the question of mental continuity between animals and men.*

In short, let's not forget that animals are human, too. Writing about the inventiveness of chimpanzees, Wilson remarks in *Sociobiology* that it is "of surpassing interest to know all of the many ways they use tools and form traditions. Each scrap of information on this subject obtained in future field and laboratory studies, however loosely connected to previous information, should be regarded as potentially important." Why stop with the chimpanzees? □

Kimberley Snail Hunt—Round One

By Alan Solem

As a participant in the Western Australian Field Program, Alan Solem, curator of invertebrates, has been in Australia since September. The following is the first report of his continuing field work there.

The Kimberley Region of Northwest Australia is a quite large block of land, about the size of Oregon, Washington, Idaho, and Montana combined. It is inhabited by very few people, many kangaroos, countless cattle, donkeys, and goats, plus billions of bush flies. Probably 99 percent of the Kimberley is essentially snail-free, and land snails are abundant on less than one-fiftieth of the remaining 1 percent. From mid-September until just before Christmas, I've bounced and lurched 22,000 km in a landrover, traveling to, in, and back to Perth from the Kimberley, searching for these scattered snail havens. Fortune mostly smiled on my travels, and far more material was obtained than I had anticipated.

As are all expeditions, this time has been a mixture of trials, triumphs, tribulations, tragic comedy, and delights in unpredictable sequences. Perhaps the greatest continuing trial was the heat, which often reached 115° in the shade by early afternoon. All too frequently we had to be out in the open sunlight, frequently moving heavy boulders that reflected the heat back at us as we worked. Bend my head, and my vision blurred as my glasses filled with dripping sweat. Clothes were completely soaked just riding in the landrover to a collecting area, and stayed soaked all day. Water intake reached 1½ gallons a day. Our triumphs were in finding the well hidden snails, whether a lonely live few eking out existence on the fringes of "snail-habitable country," or the Ningbing Range north of Kununurra, home for the most amazing group of camaenid land snails yet known and never before visited by a malacologist. The Ningbings are a center of diversity for snails that will take several visits to work out in detail, and undoubtedly will yield many more organisms of distributional interest.

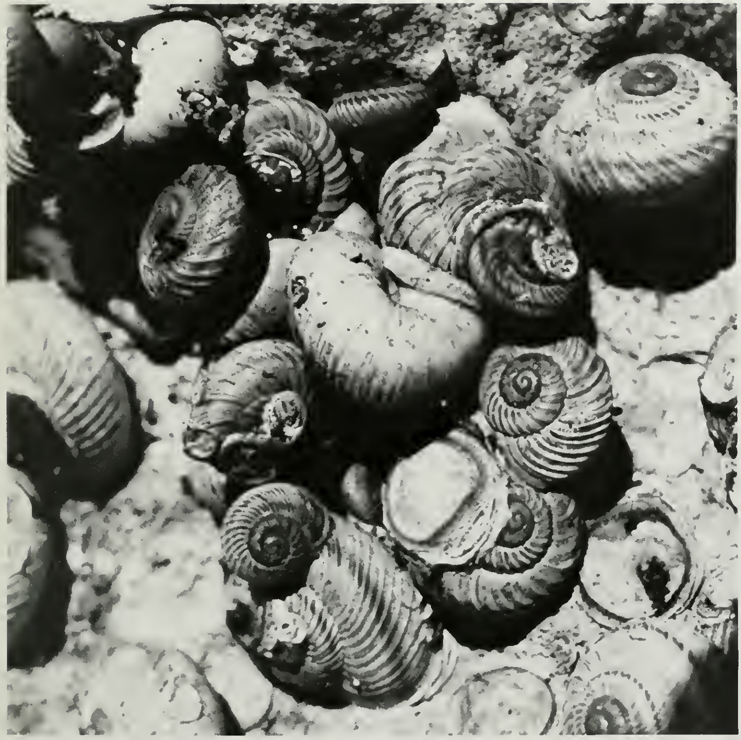
From the crack of dawn until dusk, with a few delightful exceptions, we were escorted by clouds of bush flies. Usually about half were content (temporarily) to sit on the backs of our sweatsoaked shirts, while the other half of them tried to avoid our head shakes and hand flicks to get at the moisture in our eyes, nose, mouth, and ears. At first light of dawn it was sheer luxury to lie inside a zipped-up tent and hear their excited buzzing, and watch the tent rope with a solid line of resting flies waiting for me to emerge.

Comic to the viewer, but not to the actor, was a dance and shirt removal after accidentally brushing against a nest of green ants — whose immediate reaction was to bite the nearest thing available when disturbed. More tragic was the loss of some rare, hard-collected specimens of two new species. Clutching the bag containing this treasure, I was scrambling down a steep hillside and slipped, dropping the bag, twisting in midair and sitting firmly on top of the bag, turning the prized specimens into squashed, useless mincemeat. Or after four days of snailless hunting near Halls Creek, to finally see two specimens of a minute species — crush one with my tweezers and knock the other one into a deep and unreachable crevice.

The delights were many and varied. Flights of cockatoos chattering and quarreling in the early light. Late afternoon breezes bringing relief from the heat. A green oasis, possibly holding snails, after a long dusty ride through dry savannah. That magic moment at sunset when the last fly quit bothering you until dawn. Seeing a lifestyle of great independence and self-sufficiency by the owners and managers of the stations, a pattern of living that overawes the city dweller used to specialized services. Beginning to understand the varied ways in which organisms adapt to the harsh environment of the Kimberley. Gaining greater knowledge of how and where to look for particular snails on a hillside or in a mountain range. A full moon and scudding clouds fortelling the rains to come. A myriad of impressions and memories. A sense of accomplishment as the collecting chests filled with specimens. The change from exploring new areas, to resampling known populations as I retraced my way back to Perth. The shock and joys of civilized comforts, ranging from air-conditioning to parking meters to traffic jams to pizza.

Adventures and disappointments were few, and luck in collecting mostly incredibly good. A six-week session of "rain roulette" (would we get stranded by early heavy rains, since there was precedence of a Western Australian Museum landrover getting mired in November in the Kimberley and extricated the next May) ended without our losing, and only one five-day stretch of no success in finding snails marred a highly successful exploration.

Now I am busy in Perth dissecting and measuring the collected materials so that I can plan intelligently more field work in April and May. Carl Christensen, a graduate student at the University of Arizona, and Laurie Price of Kaitaia, New Zealand, a field associate of



An undescribed species found over a 20-mile area north of Geraldton, Western Australia, that seals itself directly to rock surfaces.

Field Museum of Natural History, are carrying out biological observations in the Napier Range on the southern fringe of the Kimberley during the current wet season and mapping the detailed distribution of species along this range. Thus, the work continues in several dimensions. Illustrator Elizabeth Liebman is in Perth working with me on the anatomical variations, which are far more varied and intricate than we had anticipated. Thus, on a number of fronts, work on the grant-funded project entitled "Camaenid Land Snails of Western and Central Australia" continues actively, and smoothly.

The beginning of this study was modest and serendipitous. Back in 1964 William Turnbull, curator of fossil mammals, was going to the Northwest Cape region of Western Australia to hunt for Tertiary mammals. I asked him to "pick up some land snails for me." One day he did "pick up some snails from under the same bush." Dissection revealed peculiarities of structure far greater than I had ever seen among closely related species. The limited data available on rainfall patterns and the general ecology of the area suggested that interactions between these species, on the few days each year when they could be active, would be intense, and interesting biological ideas could be tested by studying this group.

Early in 1974, a preliminary reconaissance in the Pilbara region of Western Australia, plus the Northern Territory near Darwin and then around Alice Springs, was undertaken to see whether a major research effort was required and, if so, what areas should be emphasized. This seed money from Field Museum and the Ray A. Kroc Environmental Fund led directly to the requested funding from the National Science Foundation for this project and the entire Western Australian Field Program (see July/August 1976 *Bulletin*).

As finally evolved, my part of this endeavour, which is funded jointly by Field Museum and the National Science Foundation, is concerned with the evolution, ecology, and distribution of one family of land snails, the Camaenidae. In the New World, this group ranges from Costa Rica to Peru and on the larger islands of the West Indies. In the Old World, the camaenids extend from India and southern China to the Solomon Islands, with a great radiation of species in the northern two-thirds of Australia. Understanding the evolution and history of this group is a key to understanding the evolution of the higher land snails.

Prior to 1974, only very limited materials from Western Australia were available for study in Museum collections.

This snail has secreted a covering, the epiphragm, to retard water loss. The epiphragm is punctured with tweezers so that the snail can be readily drowned and preserved.

Casual collections over a decade by members of the staff of the Western Australian Museum, Perth, showed that a rich and highly varied fauna existed in the Kimberley region. My own collections in the Pilbara in 1974 showed that the radiation of camaenids was far greater than we had anticipated. In cooperation with the staff of the Western Australian Museum, particularly Barry Wilson, head, Division of Natural Sciences, and Shirley Slack-Smith, curator of mollusks, plans for cooperative field investigations of the Kimberley region were developed. As part of general surveys by the Western Australian Museum staff, land snails in the Prince Regent River basin were collected in 1974, the Drysdale River area in 1975, and the Napier Range in 1975 and 1976. These activities added a number of new species and enabled me to concentrate my field activities in other parts of the Kimberley. Joint investigations of the Mitchell Plateau region were made by Western Australian Museum staff and myself in October 1976, and I, together with Carl Christensen and Laurie Price, explored areas of the East and South Kimberley in November and December.

At this point, I don't know how many species we collected, and only the work of the next months will answer that question. Many of these are new to science, and nearly all are represented by enough specimens preserved in alcohol so that I can work out their anatomy and relationships to other species. The shell form is simple in this group, and many unrelated species have shells that look almost identical in size, shape, and color patterns.

From several areas I have, or will have by May, samples taken from the same populations in different months, so that I can study the sequence of reproductive activities in several species that live under different climatic conditions. The areas covered range from places with a long, dependable, heavy wet season, to places that get only four or five significant rains a year. In these places, the snails can be active perhaps 20 days a year, so I am studying how the several species have specialized in feeding, shelter-seeking, and activity patterns to minimize competition with each other.

Completing and writing up these studies will take nearly two years, and then they will be published in a series of technical reports. Here I can summarize initial impressions and give an overall "snail's eye" view of the Kimberley. Two things dominate this region — the alternation of wet and dry seasons and the annual burning of nearly every part of the countryside during the dry season. The "big wet," as it is known locally, can start as early as mid-November and last well into March. At the northern tip of the Kimberley, near Kalumburu Mission, over 100 inches of rain will fall in these months, with virtually no rainfall the rest of the year. During the period of heavy rains, even the main roads are closed to travel, and after the end of the rains, side roads, ranch tracks, and bush tracks mainly stay closed to vehicular travel for two months or more, until the creeks and rivers partially empty and until someone takes the trouble to regrade creek crossings, fill in washouts, and have a pretty good reason for entering that area. Thus, much of the back country areas may be closed for six to eight months each year. During the "wet," when the snails are active and could be observed and collected easily, travel to them is impossible. During the dry season, when the snails are hidden in secure crevices and totally inactive, travel to seek them out is possible. Thus, my field work had to take place in the late dry season.

I needed to be able to explore widely, to move on if snails were absent, to return to areas of abundance and diversity easily. I worked first the wetter areas of the West Kimberley, from Gibb River north to Kalumburu in October, collected the still very wet northern part of the East Kimberley between Wyndham and the Northern Territory border in early November and mid-November, then moving south to the drier East Kimberley in late November and early December, covering the region between Halls Creek and Fitzroy Crossing. "Rain roulette" lasted from early November to mid-December. Would we get hit by an early deluge and stranded for a few days (or much longer)? Some brief showers did soak us thoroughly, and two 1½-inch rains prevented us from going into some areas. The showers did bring local snails out of hiding, but we were not stranded. A very late start to the wet season did give us a great deal of luck in travel and collecting, but was a near disaster to many stations. One station lost 6,000 out of 34,000 cattle this dry season.

Complicating all of our collecting was the effects of fire. Natural bush fires caused by lightning or spontaneous combustion have been a part of the ecology of the Kimberley since long before man arrived, but the growing practice to fire deliberately the entire countryside each year has wrought many changes in the landscape. In the late dry season fires creep or roar (depending upon the winds) across the plains, up the hillsides and into gullies and canyons. Snails, insects, reptiles hidden near the surface are incinerated. Only those individuals lucky enough to be sheltering deep in rock piles or under boulders thick enough to insulate them from the heat of the fire survive to come out with the rains. The same lucky individuals also are safe from collectors, since rocks big enough to protect them from a roaring fire probably are too big to move.

At times, we might work six to eight hours on a series of hillsides, finding dead shells, but no living specimens. We might try five or six places in a mountain range before hitting a small pocket of shaded, moist rocks with four or five adult snails within excavating distance of our hands and crowbars. Or, on occasions, we might find an area of incredible abundance, which we photographed and collected in with great joy. Simple turning of a rock might yield 20 or 30 live snails sealed to its underside, as shown on page 7, or excavating in a rock slide an area two feet square and a foot deep yielded a pile of dead and live snails. To balance these areas of abundance, two visits to the Limestone Billy Hills east of Fitzroy Crossing yielded exactly one live snail.

How do we decide where to search? What clues do we use? Partly it is hunch and intuition while looking at topographic and geologic maps. Once we have entered an area, there are several clues. If snails are abundant, then dead, bleached shells on the bare ground (fatalities of desiccation or fire in previous years and washed out by the last rainy season) indicate living snails up slope (or at least in the recent past). In fringe areas, we must search for pockets of moisture, a few fig trees in a shaded canyon, or a pile of boulders above the flood level of a nearby stream. Places where snails can survive the long and harsh dry season of the Kimberley area. Shaded slopes of ravines, but not areas scoured out by the raging torrents produced by several inches of rain. An art of looking, not a science.

So "Round One," the exploratory search in probably the largest area of the world previously unsampled for land snails, is over. "Round Two," study of this material to enable maximum effectiveness of additional field work is underway in Perth, with additional rounds of field work, study, write-up, and publication of results to come.

Members' Nights

Members' Nights, customarily held during the spring, will occur this year in the fall: on October 6 and 7. The change has been made to avoid conflict with viewing of the special "Treasures of Tutankhamun" exhibit, which will be featured at Field Museum from April 15 through August 15.

Members should make note of the fact that a special preview of the Tutankhamun exhibit, for Members only, will be held on Wednesday and Thursday, April 13 and 14, from 10 a.m. to 9 p.m. The exhibit opens to the public on Friday, April 15.

Waterways of Ancient Peru

Sophisticated irrigation systems of the Moche and Chimu empires rivaled modern technology

By Michael Moseley

The world's increasing population confronts man with the pressing problem of how to feed his ever-growing family. One course of solution lies in transforming the deserts that cover one-eighth of the land surface into fertile food-producing regions. How this transformation might be achieved is a core question of Field Museum's *Programa Riego Antiguo* (Ancient Irrigation Program), a multidisciplinary investigation of prehistoric irrigation agriculture on the arid coast of Peru.

Sandwiched between the rugged Andes Mountains and cool waters of the South Pacific, the Peruvian Desert is a long, narrow strip of barren waste. Showers of consequence fall about once per decade, and 1925 witnessed the last torrential rains of major significance. The dearth of precipitation makes this one of the bleakest, most barren landscapes in the world. Travelers can cross miles of sand-strewn plains and parched hills without encountering a single cactus or blade of vegetation.

Yet, as an archaeologist who has wandered this shadeless wilderness for more than a decade, I can attest to its extraordinary content of numerous archaeological sites and impressive ruins. Long-abandoned villages dot the shoreline one after another, while sun-bleached walls of forgotten cities push back into desert dunes beyond the track of modern men. Indeed, the ancient societies of the Andean coast have left behind tracery of once-thriving civilizations that rank with the Inca and Aztec as the most sophisticated and evolved of any in the native New World.

To ask how vast populations and splendid civilizations once flourished in the desert is to ask how man fed himself, and fed himself well. Understanding rests first on knowing what nature offered, and second on knowing how man manipulated nature's offerings. At a glance the desert is baked and barren. Yet, in many ways nature offers compensating hospitality. ➤

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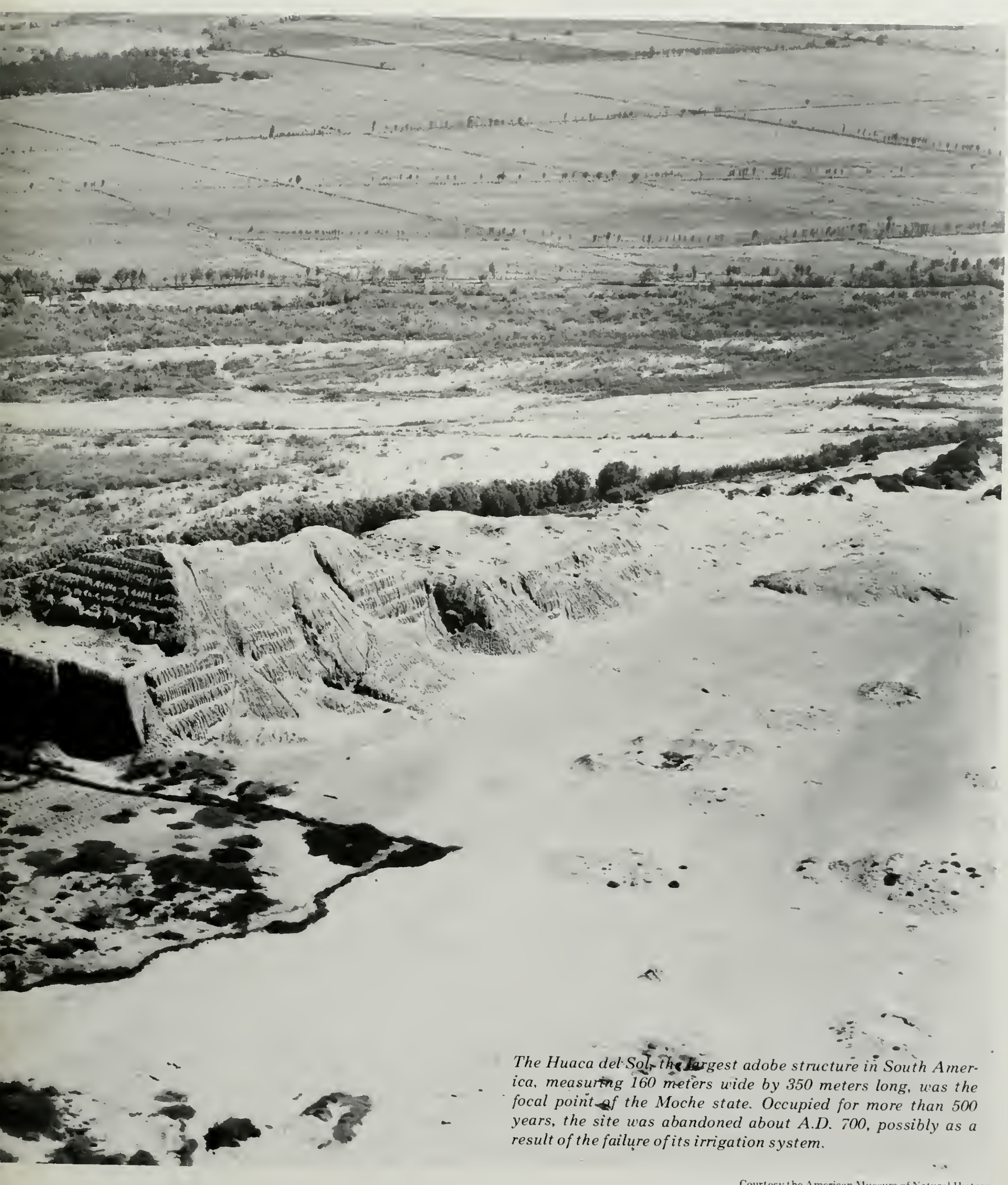


The Huaca del Sol, the largest adobe structure in South America, measuring 160 meters wide by 350 meters long, was the focal point of the Moche state. Occupied for more than 500 years, the site was abandoned about A.D. 700, possibly as a result of the failure of its irrigation system.

Courtesy the American Museum of Natural History

Courtesy Michael Moseley

Charles Ortloff, hydrologist, sites a level down an abandoned canal. Such preliminary measurements are followed by precise surveying which is necessary before the workings of the canal can be reconstructed.

First, the coastal plain, though dry, is remarkably cool and constant in temperature. A consistent ocean breeze rarely allows the thermometer to push above 90° or fall below 65°. Contemporary concerns such as air conditioning or central heating have little relevance in this amenable climate.

Second, wildlife in the coastal waters is uniquely bountiful. The marine biomass is the most abundant of any in the New World oceans, and today Peru surpasses all other nations in fishing. Thus, a rich seafood cuisine has long been available to ancients and archaeologists alike.

Third, favorable temperatures, and near-constant sunshine create hothouselike conditions for plant growth, leaving only water as the missing ingredient for productive agriculture.

Fourth, and finally, towering tens of thousands of feet above the desert, craggy Andean mountain peaks catch rain clouds and gather substantial precipitation, some of which cascades down the western continental slope in short streams and rivers. Spaced 15 to 20 miles apart, these watercourses cross the arid coastal plain creating oasislike valleys before disgorging into the sea. These greenhouse valleys shelter an auspicious combination of water, land, plants, and sun that has long attracted man.

That is what nature offers. However, the rise of large populations and great civilizations is a story of how Andean people created an artificial symbiotic relationship that interposed man in conjunction with water, plants, and land. Investigating this symbiosis is the concern of the *Programa Riego Antiguo* (P.R.A.). The study area is the valley of the Rio Moche, where I and many of the P.R.A. staff worked previously. This work began in 1969 and dealt with the immense ruins of Chan Chan, the sprawling adobe capital of the Chimu empire. Between about 1,000 and 1,400 A.D. Chimu rulers forged together a mighty coastal empire stretching from southern Ecuador to central Peru. Then the empire did battle with its greatest adversary, the Inca, and upon losing passed into obscurity shortly before the arrival of Pizarro's conquistadores. Our archaeological explorations dealt with earlier phenomena as well, including the Chimu's political predecessors, the Mochica or Moche state, which was another populous desert kingdom. Its capital was on the south side of the Rio Moche at the site of the *huacas*, or pyramids, of the sun and the moon. Built around the time of Christ, the two enormous adobe mounds are probably the largest mud-brick constructions in the New World.

Yet, finding or exploring great ruins does not tell us why they were there or how their builders made a living and supported themselves. These are the more arduous sides of archaeology. Excavation and recovery of mummified food remains demonstrate that the Chimu and Moche peoples based their economies on productive agriculture. Aerial reconnaissance and jeep survey of the wastelands on either side of the Rio Moche have revealed vast prehistoric canals and extensive ancient field systems spread over many miles. This was a key find.

The great canals and expansive fields comprise the economic fossils of Prehispanic agriculture that solemnly testify to man's former skills in making the barren desert productive. They owe their survival and preservation to forgotten builders who made the watercourses larger and longer than the modern canals, encompassing far more land than is farmed in the same region today. Of course the ancient presence of massive waterworks is not unexpected, since productive farming had to support the people and enterprises of the Moche and Chimu empires. However, the unexpected lies in the disparity between the amount of land farmed today and the larger amount of land reclaimed by Precolumbian people—agricultural productivity was demonstrably greater in the past than in the present!

In the summer of 1976 the P.R.A. staff initiated field studies of the Prehispanic irrigation system in the Moche Valley. Supported by the National Science Foundation, the program goal is to generate an understanding of the strategy and technology of ancient agriculture. Sophisticated irrigation systems are highly complex phenomena. Today, planning, constructing, and operating such systems requires skills of specialists trained in many different disciplines. Recreating and recapturing the planning, building, and running of an equally sophisticated but long-abandoned system is a new scientific endeavor, no less demanding of skills from many fields. Thus, the P.R.A. staff includes not only myself, Thomas and Shelia Pozorski (Field Museum research assistants), and Eric E. Deeds (Harvard University) as archaeologists and anthropologists; but a hydrologist, Charles R. Ortloff (University of Portland); a geographer, James S. Kus (California State University, Fresno); a soils geologist, Fred L. Nials (Eastern New Mexico University); and a palynologist (a botanist who specializes in the study of pollen), Lonnie Pippin (Washington State University); in addition to participating Peruvian scientists.

A first step in the P.R.A. studies was calculating the maximum expanse of land farmed with water diverted from the Rio Moche in prehistoric times. Using aerial photographs of the lower valley, Eric Deeds traced out ancient canals that reclaimed 211 square kilometers of terrain and contrasted this with recent agriculture in the same area, which embraces only 128 square kilometers, or about 40 percent less land. The next step entailed qualifying these figures. Contemporary agricultural practices have a relatively short history, starting less than five centuries ago with European conquest and colonization of the Andes. In contrast, native hydrology developed slowly over the course of more than three millennia. Thus, all Prehispanic canals in the Moche Valley were not necessarily built and used at the same time.

Our studies indicate people began diverting discharges from the Rio Moche onto the parched desert by 1500 B.C. Thus, man interposed himself in a symbiotic agricultural relationship with land, plants, and water at an early date. Canals were first built upstream in areas of steep gradients where water flow was easy to control. With time new channels were dug further down river nearing the coast. Ultimately, the ancient irrigation system assumed a configuration similar to a series of nested Vs (>>>). The point of each V represents the intake of two canals at the Rio Moche. The diverging arms of the V reflect the course of the canals as they spread apart from the river and reach out into fertile lands near the shore.

When the Moche Empire rose to power, irrigation

Massive aqueducts and rock cuts were necessary to build the La Cumbre Canal, which brought water 70 km south from the Chicama valley to the fields of Chan Chan.

Courtesy Michael Moseley

was well established; however, much river water still escaped into the ocean without productive use. People of the desert kingdom quickly expanded the canal system on both sides of the river, bringing wide tracks of new land under cultivation and reducing the loss of water. Dug by hand, the toil of thousands of laborers went into the waterworks. This tremendous investment in expanding the local economy probably correlates with the valley being the seat of the empire, and the rulers at the sun and moon pyramids having extensive human resources at their command. Work with geologist Nials and palynologist Pippin near the old capital on the south side of the valley revealed evidence of a severe blow to the Moche economy: sometime after the expansion of the southern canals vast quantities of wind-borne sand began accumulating behind the beach. Pushed by ocean winds, waves of dunes slid across the southern fields, eventually choking off the main canals and cutting the water supply to the sun and moon pyramids. Today, blankets of soft sand often 10 to 20 meters thick cover much of the south side of the valley, destroying its economic potential. P.R.A. staff members are attempting to discern if this destruction resulted from man's mismanagement of his resources, or simply from a quirk of nature.

When the Chimu subsequently assumed power it is little wonder that they turned their attention to the region north of the river and built Chan Chan there. Wide, flat plains abound north of the river. Even with dunes smothering the southern fields, a scarcity of water—not arable land—remained the critical factor in farming. The Chimu enlarged and extended the northern canals to about twice their former size. Opening so much land put supply pressures on the Rio Moche. Compensation was sought by constructing a giant 70 km-long canal to bring water from the next river valley north to the vicinity of Chan Chan. This great intervalley conduit, the La Cumbre canal, ranks as one of the most prodigious engineering feats of the Precolumbian World. Again the extraordinary labor investment made in this canal and other Chimu irrigation works correlates with the valley being a

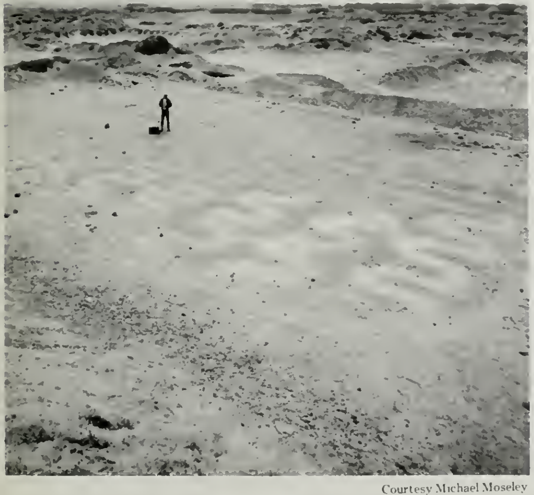
Workmen clear administrative structures in one of the Ciudadelas *("palaces") of Chan Chan, the capital of the Chimu empire. From this center, the Chimu rulers controled a 1,000-mile-long empire, second in size only to that of the Incas.*

Courtesy Michael Moseley

major political center commanding vast human resources.

The Chimu agricultural system is the largest and best preserved of the ancient hydrological undertakings in the P.R.A. study area. Thomas and Shelia Pozorski began canal excavation studies with these remains at the same time that geographer Kus started mapping the associated fields. Although preliminary in nature, the research suggests the strategy of native engineers emphasized efficiency and long-term stability. Many canal excavations reveal little evidence of either annual cleaning or maintenance. Some channels seem to have transported water for decades with no need for systematic upkeep. Fields, likewise, show few signs of annual plowing or reworking. Furrows conducting water to individual plants are not laid out as today in parallel, straight lines. Instead of allowing water to flow directly from one end of a field to the other, ancient furrows were cut in a tight zigzag fashion. This required water to move back and forth in a sinuous or S-shaped course. The intent was to allow the water time to soak in, presumably producing higher yields with less water. One problem now confronting the staff scientists is to identify specific Chimu crops by examining ancient pollen in the fields. When completed, this work will contribute to exact quantitative assessments of early agricultural productivity.

Precolumbian furrows, such as these in Chan Chan, are easily recognized by their folded, S-shaped path, which maximized scant water resources by giving the water time to soak into the desert soil.



Courtesy Michael Moseley

The La Cumbre canal is in many ways the Chimu's greatest hydrological monument. Yet, studying the desiccated and long abandoned conduit is a formidable task. Simply cleaning the La Cumbre and rebuilding its numerous fallen aqueducts would be an undertaking running into the millions of dollars. Instead, hydrologist Ortloff has to work with widely spaced archaeological cuts revealing the dimensions and configuration of the old channel. He then walks and maps sand-filled stretches of canal recording when the banks widen, narrow, or elevate —each change possibly affecting the original flow and water velocity. Once relevant statistics are recorded, the next step is to run "theoretical water" through the mathematically reconstructed section of canal. We call this "theoretical water" because the nearest real water is miles away and modern technology has no practical means of filling the La Cumbre canal. Nor can it tell us how much water the conduit carried, how fast, or by what means it slowed the water's velocity upon reaching an aqueduct and then increased flow again after safely crossing. This information has to come from mathematical models and the physics of fluid dynamics. The multiple-step calculations involved lie beyond the mathematical ken of an archaeologist such as myself, but apparently not beyond the understanding of Chimu technicians. Less than 5 percent of the La Cumbre has received such study to date, but the initial findings suggest native engineers had a truly remarkable grasp of the empirical end of fluid dynamics. What the P.R.A. staff is currently struggling with is whether or not this grasp and knowledge was equal to or greater than the understanding modern hydrologists have about irrigating the same region.

Thus, in overview the Field Museum has launched a program of inquiry into a new but very relevant topic of investigation. Like many pioneering studies, the P.R.A. staff generates as many questions as answers. It now seems likely that ancient engineers may have consciously manipulated the underground water table. This would have been advantageous in assuring a continuous source of water to the 125 wells supplying Chan Chan, in addition to feeding farm areas below the city with subsurface water.

P.R.A. members will have to move a lot of theoretical water through a multitude of calculations to assess these and other propositions. However, with continued support from the Field Museum and the National Science Foundation, the past strategy and technology of irrigation agriculture will undoubtedly offer modern man much in the quest to feed his ever-growing family. □

Letters from Antarctica, 1976-77

By Edward Olsen

The following report is the second from Edward Olsen, chairman of the Department of Geology and curator of mineralogy, who has been searching for meteorites in Antarctica.

The only word that adequately describes the scene that meets your eye, as you emerge from the plane which has just landed you in Antarctica is *awesome.* The seventy or so individuals in our flight walked out onto ice and no one said a word, even those who had seen this sight before.

The sun shone brightly on white, white sea shelf ice. To the east, Mt. Erebus stood, 12,450 feet rising from sea level—a snow-clad volcano with smoke billowing from its crest. To the west lay the Royal Society Range, white craggy mountains with streamlined, curving glaciers sweeping between the peaks to the shores of Ross Sound. It is a sight relatively few have seen; one impossible to forget.

We were soon picked up by a truck with an oversize plywood cabin set on it—the so-called McMurdo bus. We drove slowly over the dazzlingly bright ice shelf to the shore of Ross Island, up the slope of the shore, and into McMurdo Station. Because there is no flat place on Ross Island for an airfield, the planes land on the permanent ice shelf that surrounds the volcanic island on three sides.

McMurdo Station is the largest "town" in Antarctica. It consists of about 50 buildings that house the science operations in the interior of the continent, and the U.S. Navy Support Force that provides transportation, supply, construction, and equipment. In 1961, seventeen nations signed a 30-year treaty setting aside Antarctica for peaceful, noncommercial, scientific studies. The nations that are active in research here are the U.S., Britain, U.S.S.R., New Zealand, Japan, Argentina, Chile, Germany, Italy, Poland, and Australia. In the U.S. the research program is called USARP (for U.S. Antarctic Research Program). It is operated entirely by the National Science Foundation. The annual budget is $45 million, with $5 million of that going for the scientific programs, and $40 million for the naval support force. It seems clear that the main reason for such an expenditure is not primarily to support science, but rather to maintain a U.S. presence in Antarctica. The U.S. keeps four year-round stations: McMurdo, South Pole, Siple, and Palmer, with smaller stations manned only during the summer months, November through February.

The time will come, 1991, when the 30-year treaty will have run its course and need renegotiation. In a world increasingly starved for natural resources, the negotiation will be less simple than the last one. There is oil here, along with coal, chromium ore, copper ore, and a host of other metals utilized by a modern technological society. Shortages 25 years from now will make it possible to consider mining even in this most inhospitable climate on earth. Already some nations are seining the ocean waters inside the treaty boundary for krill—small shrimplike creatures that are a rich source of protein. Sealing and whaling went on here after the treaty was signed, and threatens to be started again by some countries in spite of the current treaty. A U.S. presence here is desirable—for if we are not here, others will be here anyway, and we will have no say in future negotiations.

Well, back to my letter, and the purposes for which I came down to this strange land. The first week in McMurdo was spent getting together supplies and equipment. I also spent two full days in a snow-and-ice survival school. I learned how to spend a night dug into an ice trench, how to use an ice axe to climb ice and snow cliffs, how to use crampons, how to recognize crevasses and climb out of them if you fall in. Walking through deep crevasses in an active glacial tongue is an eerie experience. It's a world of icicles and a pale blue aura all about you.

After the week, our party got together for final plans. It consists of us two Americans (Dr. William Cassidy of the University of Pittsburgh, and I) and one Japanese, Dr. Keiso Yanai of Japan's National Institute of Polar Research. Dr. Yanai has worked for eight summers in the Antarctic, and eight years ago made a trek from the coast, over the ice to the South Pole. He was a main factor in the successful search for meteorites the Japanese made over the past several summers near the Yamato Mountains. He personally recovered about 600 of the 992 specimens they recovered. Having him along makes me feel a good deal better. So, it is a joint U.S.-Japan expedition. We signed a formal agreement on the partition of any specimens recovered.

Our first field camp was at the foot of Wright Upper Glacier in one of the unglaciated "dry valleys" on the west side of McMurdo Sound. There are a series of half-a-dozen valleys that were obviously once full of glaciers, but are now bare rock, the glaciers having wasted away.

No one understands why they stay dry. Each valley has glaciers at the upper and along its sides feeding into it, but although the ice moves down into the valley the front wastes away by some summer melting and (mostly) wind erosion at the same rate—so there is no net advance into the valley.

Our first camp was a rock at the very edge of the glacial tongue in the Wright Valley. Down the valley were bare rock outcrops and glacial boulders. No plants, no birds, no animals—the valley floor looks like Mars. I found a little orange lichen and a rare kind of black lichen—just a few tiny specks on rocks. No sequoia ever looked so good to my eyes. How on earth do these exist here? Very dry (less than a few inches of annual precipitation), total darkness and bitter cold in the winter, and short, cold summers. It's amazing.

The valley is surrounded by towering mesas and buttes of sedimentary rocks and igneous sills. It looks exactly like parts of Utah, and northwestern Colorado.

The first day in the field, the weather was cool, about 38°F and mildly breezy. Dr. Yanai and I took a 14-mile trek on crampons over the Wright Glacier looking for meteorites. We probably passed some; however, the number of glacial boulders was so great it would be impossible to spot them unless we walked right onto one.

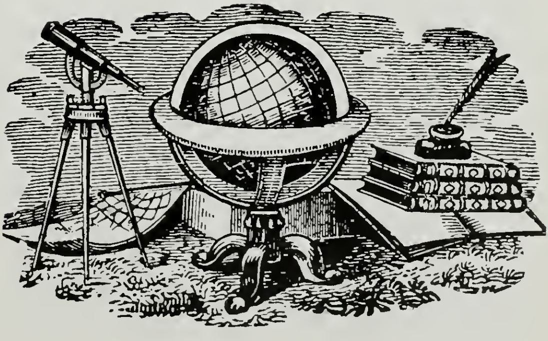
The upper end of the glacier is fed by ice in an unusual way. The polar plateau here ends in a 1,000-foot cliff of rock, about four miles wide. Over this, spill several icefalls—enormous masses of ice that look like so many frozen Niagaras. It is an awesome sight. We searched the foot of the falls, but found no meteorites. It is a dangerous avalanche area.

The next day, Dr. Yanai and I trekked the five miles or so of terminal moraine rocks that are bulldozed up along the end of the glacier, just in front of our camp. We found nothing other than the rocks of the valley walls. It was decided that the best place to continue the search would be up on the polar ice cap, in a situation similar to the kind of place where the Japanese had such success. After a couple of days waiting for the Navy helicopter, it arrived and moved our camp about 10 miles to the southwest, up onto the polar cap at an elevation of about 6,200 feet. We set up camp in a spot I never would have chosen. We were on a thin patch of dry snow right out in the middle of the ice sheet. Only half a mile away were some level rock benches protected by ridges of outcropping rock. Our ice camp sloped badly, which created a number of problems. Also, with no protection, our equipment must all be staked down into the ice, or weighted down.

The first day the weather was excellent. We traversed the open ice to the west. Dr. Yanai, with binoculars, spotted a black rock all alone in the middle of a blue ice area. Blue ice is, incidentally, ancient ice that has recrystallized to larger crystals, which take on a pale blue color. We trekked on crampons over to it. It was a meteorite! I could not tell the type it is right off. It weighed an estimated 3,000-4,000 grams (later weighing it came to 4,108 grams—about 11 lbs.). Almost at once, we spotted another black spot about half a mile off. It, too, turned out to be a meteorite of at least 10,000 grams, maybe 15,000 grams! (Later weighing, it came to 13,782 grams—about 37 lbs.). Binocular search of the rest of the region showed nothing. Because of the rolling undulations of the surface one can't see very far off.

We left markers where we found them, photographed them in position, and then packed them a half mile back to camp. Then the weather closed in. During the night the sun shone brightly, not a cloud in the sky. However, the wind rose to a constant 25 mph, the tents flapped and popped, and the temperature fell to about 6°F. After a dinner of sukiyaki and cup of warm saké, we crawled into our sleeping bags with all our clothes on—heavy socks, wind pants, thermal underwear, wool shirt, even mittens and hat with ear flaps pulled down. After shivering for a while, each person pulled a towel over his eyes to block out the all-night sunlight and tried to go to sleep. Beneath your sleeping bag is a thin rubber pad, a thin layer of snow, and then hard blue glacial ice. As you lie there you hear, deep down beneath you, a sound like the whipping of a sheet of metal—*wuk, wuk, . . . wuk*—followed by a slow, groaning sound. These are the sounds of the glacial ice moving, ever so slowly, downhill. It is an eerie sound, and occasionally when it ceases for ten minutes or more, you hold your breath, fearing that the quiet period will be followed by a sudden cracking, and a small crevasse will open right under your sleeping bag. But then it starts again—*wuk . . . wuk . . . wuk . . .* groan. A unique experience.

(Continued on p. 19.)



field briefs

Trustees Named

George R. Baker and O. C. Davis have recently been elected to five-year terms on Field Museum's Board of Trustees. Mr. Baker is executive vice president of General Banking Services Groups, Continental Illinois Corporation, and a director of Midland Company, Reliance Corporation, Reliance Insurance Company, and W. W. Grainger, Inc. He is chairman of the Continental Illinois Leasing Corporation and for both the Better Business Bureau of Metropolitan Chicago and Continental Illinois Venture Corporation he serves on the boards of directors. Mr. Baker is also a member of the executive board of the Chicago Area Council Boy Scouts of America.

Mr. Davis is president and director of Peoples Gas Co. He serves as a director of Harris Bankcorp, Inc.; Harris Trust and Savings Bank; AMSTED Industries, Inc.; The American Gas Association; and the Chicago Crime Commission. He is also district vice chairman of the Illinois State Chamber of Commerce, a member of the National Petroleum Council, and is on the advisory council (natural gas) to the U.S. Secretary of the Interior.

New Gallery Opens

The Museum's newest gallery, "The Place for Wonder," officially opened on January 24. The attractive ground floor facility does what all museum visitors wish museums would do: it allows people to touch things. Here one can pet a stuffed owl and feel the way its feathers fluff softly back in place as it is stroked; handle a vacated wasp nest; play a West African musical instrument; turn quartz crystals to catch their sparkle in light. The choices are almost unlimited in *The Place for Wonder*, a special experiment in museum visiting.

In bright, comfortable surroundings, children and adults find drawers of museum treasures stacked in butcher-block tables. In each drawer, a question card suggests ways to learn about objects: "How do you think people used this tool?" "Does this fossil remind you of a plant or animal living today?" Carpeted benches serve both as seats and counters, allowing visitors to conveniently examine materials related to major Field Museum exhibits. Walls are painted in pimento and orange; one wall is covered with some 60 varieties of rare tropical hardwoods and four Illinois woods. The tables and benches continue the natural spirit of the wood wall. The innovative design is the work of Donald Skinner, chief graphics designer at the museum.

Trained volunteers are on hand to answer questions and to point the way to a new awareness of the museum's regular exhibits. Funds for this exciting new gallery were contributed by the Service Club of Chicago.

Birders: Raise Your Binoculars!

Field Museum members with an ornithological bent will be interested to know that a birding excursion to Horicon Marsh, 50 miles northwest of Milwaukee, Wisconsin, is scheduled for Saturday, April 23.

A deluxe motor coach will pick up participants at Field Museum at 7:00 a.m. and return in the evening. Total cost of the outing is $15.00 per person, which includes a picnic lunch. Participants should bring a scope or binoculars and sufficient warm clothing and wet weather outerwear and boots in the event of inclement weather. (Clothing that is not needed may be safely left in the motor coach.)

The excursion will be led by Mrs. Roger Brown, past president of the Evanston-North Shore Bird Club; assisting will be Mrs. James Ware, also a past president of the club. The number of reservations is limited to 38, so persons interested in the outing are advised to send in the coupon at right (or facsimile), together with the $15.00 fee as soon as possible. These should be directed to Dorothy Roder, Membership Department, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il 60605.

Field Museum Horicon Birding Trip
April 23, 1977

I wish ________ reservations for the Horicon Birding Trip.
(how many)

Name ________________________________

Address ________________________________

City ______________ State ________ Zip ________

Telephone: ________________________________

Amount enclosed ($15.00 per person) ________________
(make checks payable to Field Museum)

Return this coupon (or facsimile) today!

ANTARCTICA *(Continued from p. 17.)*

The next day we remained huddled in the tent while 30-35 mph winds lashed the tent walls. The temperature was 1°F and the wind chill must have been somewhere around -30°F. All you can do is try to sleep. You can't get out and walk around because, on the slippery surface, the wind can knock you down and set you sliding down the glacier slope. You can't even read in your sleeping bag because your fingers, in mittens, become painfully numb in five minutes and you can't turn the pages. Before the cold gets you, you're convinced you'll die of boredom.

The next several days the wind dropped to about 15 mph and we could go out and traverse the blue glacial surface. No additional meteorites were discovered.

By radio we arranged for a Navy helicopter pick-up to go back to McMurdo Station for a few days of rest. The climatic conditions, on the ice cap, in tents, are severe enough that one becomes totally weary after a couple of weeks. Happily our much needed rest coincided with Christmas. We left the camp standing and went back to McMurdo, and a shower, shave, and a Christmas dinner in the Navy mess hall that consisted of turkey, ham, filet mignon, shrimp cocktail, sweet potatoes, raisin sauce, oyster dressing, corn, peas, salads, cranberries, rolls, pumpkin pie, pecan pie, fruit cake, ice cream, coffee, milk (powdered), and a choice of wines. After a couple of weeks of cold biscuits, clammy bacon, stale bread, Japanese sukiyaki, and pepper soup, we were ready for this feast.

Speaking of food, for anyone who has camped out in more moderate climates, camping habits in Antarctica are unusual. There are no bears, no mice, no ants, no flies, no hot sun, and no rain. As a result, food can be left out anywhere, in any condition. A half-eaten loaf of bread, half a boiled ham, etc. can be set outside of a tent, in the open, unwrapped, and a week later be just like it was when you put it out, only perhaps a little drier. Nothing attacks it or causes it to decay! On the other hand, there are major disadvantages. Butter is never softer than a rock; you do not butter a piece of bread, you hack off butter chips and crunch them up on a piece of bread. Canned juices, from which you need daily vitamin C, have to be cut open and the "juice" chopped out and either eaten like sherbet or melted before you can drink it. Canned fruit, similarly, must be chopped out and melted before it can be eaten. Virtually everything you eat is "on the rocks."

Dishes can't be washed with soap because the water, made by chopping glacial ice and melting it, is so ultrasoft the soap film clings to dishes. Nor can dishrags be used because once wetted they freeze solid and there's no warm place to dry them. Instead, dishes are wiped clean by using wads of dry toilet paper.

Because it is such a chore to get water (it takes a long time to melt ice on a small camp stove) you don't use it for washing, nor is it desirable to wash. Wet hands chap easily. Finger tips then split and bleed. Hands are cleaned by grabbing a chip of granular snow and rubbing your hands with it. It removes dirt before it melts much from hand heat and gets you only minimally wet. Tooth brushing is done conveniently with snow also. It makes your teeth ache, but they do clean up.

After a few days of rest in McMurdo, we flew back to our camp, loaded it in the helicopter, and flew southwest, higher onto the polar cap, to the Mount Dewitt nunatak. (A nunatak is an Eskimo word from the northern arctic, that describes an isolated peak of rock sticking up through an ice cap.) Here we found a better camp spot in a small hollow surrounded by rock on three sides and a steep wall of polar cap ice on the fourth side. In this depression we were somewhat protected from stray winds. Dewitt nunatak is surrounded by vast areas of blue ice, and a promise of further meteorite finds.

For the first couple of days the winds were only 15 to 20 mph, and temperatures around 8°F. The area is about 7,500 feet above sea level and we expected colder, windier conditions. They came! The winds picked up to 40 mph, and the temperatures hovered around 2° to 5°F. For the next four days the winds continued, and traverses across open ice on crampons were difficult. Then, quite suddenly, one evening the wind stopped completely. The utter silence was overwhelming. It continued for over a day that way. New Year's Eve, we cheered at the midnight hour as we trudged over the ice, taking advantage of the windless conditions. We crossed some heavily crevassed areas, hopping nimbly over them, and avoided stepping on snow bridges. I deliberately kicked down a snow bridge into one, and peered into a cold, blue world that went dozens of feet downward.

Out on our New Year's Eve traverse two things happened. While hiking along, two skuas (sea birds) flew by. They were more than 50 miles from the coast. It was a shock to see other living creatures in this utterly lifeless world. I waved to them and one flew to me, hovered for almost 15 seconds over my head, looked at me intently, and then glided away. I enjoyed the brief visit. Later we ran across a large glacial boulder. It was coal-rich shale and we found fossil wood, leaves, and bark of trees that once lived in Antarctica, 350 million years ago, when this continent was a tropical, life-filled place.

Until Antarctica I had never realized how much I was conscious of living plants and animals when out-of-doors. Here, with virtually none of these, there is a very lonely and unsatisfying aspect to the land. The air itself, lacking the aromatic scents of trees, grass, and flowers, is completely pure, and uninteresting. Breathing the air is like drinking distilled water—completely tasteless.

As I write this, no new meteorite finds have been made, although we have traversed miles of windswept ice fields like those on which the Japanese made so many finds a thousand miles away. Although this is disappointing, I am still pleased we found those we did. □

March and April at Field Museum

(From March 15 through April 15)

SPECIAL PROGRAMS

Ayer Film/Lecture Series. This series highlights familiar and not-so-familiar areas of the world. Saturdays, at 2:30 p.m., in Simpson Theatre, ground floor.

March 19	*The Great City of London* by Doug Jones
March 26	*The Huichol—Tribe of the Sacred Cactus* by Kal Muller
April 2	*The Andes* by Thayer Soule
April 9	*The Real Yellowstone* by Fran William Hall

Spring Journey for Children—*How to Read a Bird.* An activity-oriented self-guided tour through the museum's bird halls, including a visit to the museum's newest diorama, the Salt Marsh, in the *Man in His Environment* exhibit (Hall 18). Learn about birds: compare their beaks, their feathers, their sizes and shapes. Families will enjoy Journeys too. Journey sheets are available at the information booth.

Adult Education Courses—Spring Series. Natural history and anthropology noncredit courses are being offered to ages 18 and over, beginning in April. Watch your mailbox for a special *Adult Education Courses* flyer. We recommend that you register early because class enrollment is limited.

SPECIAL EXHIBITS

The Place for Wonder. Visit the newly opened *The Place for Wonder* gallery. Open to visitors of all ages, this room provides a "hands-on" approach to natural history. Staffed by volunteers, it is open to the public promptly: weekdays, 1 p.m. and 2 p.m.; weekends, 10 a.m., 11 a.m., 1 p.m., and 2 p.m. Located near the new cafeteria, ground floor.

Male and Female: Anthropology Game. This game/exhibit of 38 artifacts is a great way to learn that economic and social roles of the sexes are not universally the same. South Lounge, 2nd floor. No closing date.

Man in His Environment. This exhibit takes a global view of some of the most serious environmental problems confronting all mankind and asks visitors to involve themselves in these problems —and the need for solution. Hall 18, main floor. Permanent exhibit.

CONTINUING PROGRAMS

Weekend Discovery Programs. Saturdays and Sundays, 10 a.m. to 3 p.m.: take tours, follow demonstrations, participate in museum-related activities.

The Ancient Art of Weaving. Members of the North Shore Weavers' Guild demonstrate weaving and spinning every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

SPECIAL-INTEREST MEETINGS OPEN TO THE PUBLIC

March 15, 7:30 p.m.	**Chicago Audubon Society**
April 5, 7:30 p.m.	**Kennicott Club**
April 7, 7:00 p.m.	**The Primitive Arts Society**
April 8, 8:00 p.m.	**Chicago Anthropological Society**
April 12, 7:30 p.m.	**Chicago Nature Camera Club**
April 13, 7:00 p.m.	**Chicago Ornithological Society**
April 13, 7:30 p.m.	**Windy City Grotto, National Speleological Society**

MARCH AND APRIL HOURS

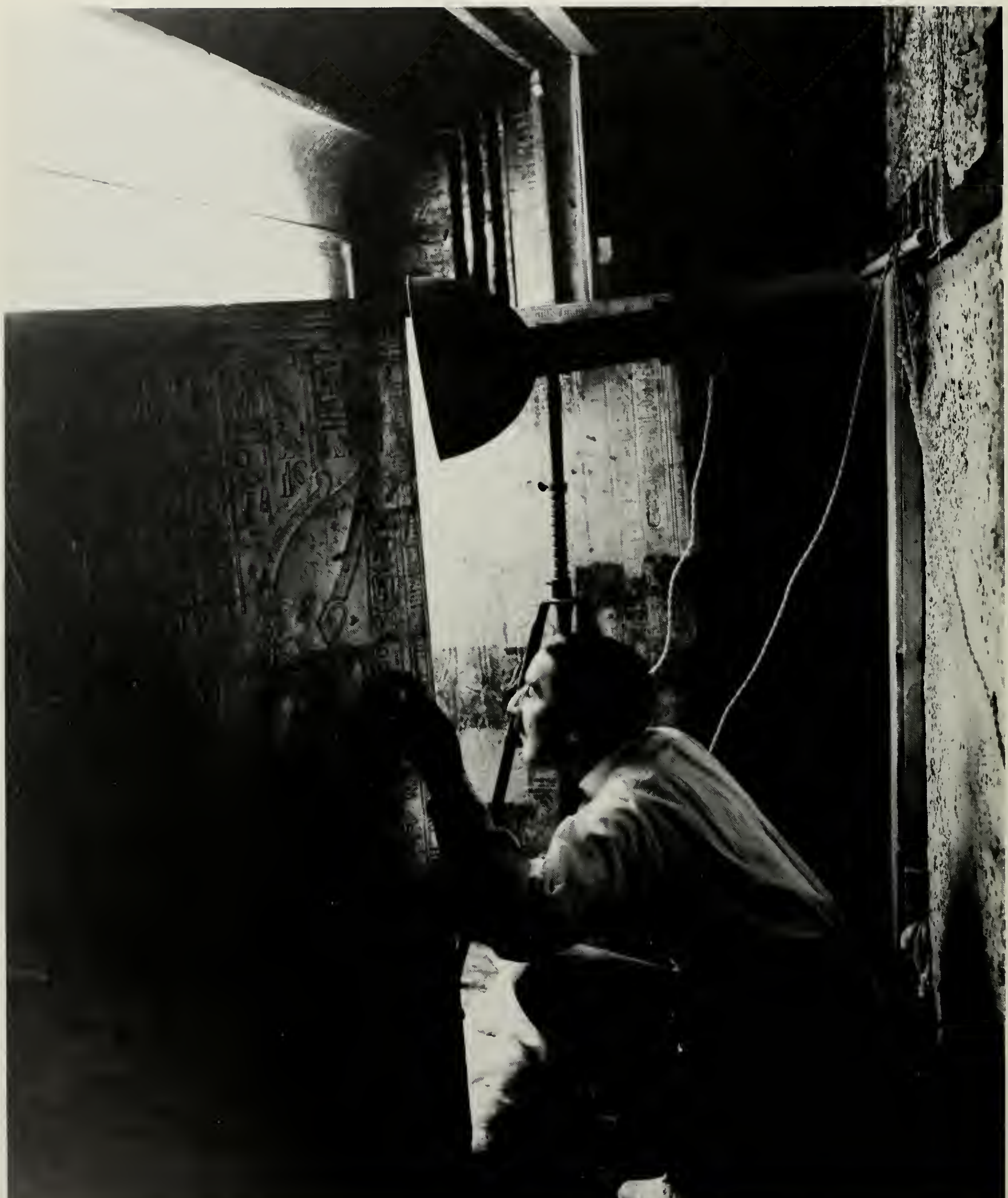
The Museum Opens daily at 9 a.m., closes at 5 p.m. During the *Treasures of Tutankhamun* exhibit, April 15 through August 15, the hours are 9 a.m. to 6 p.m. Monday through Wednesday and 9 a.m. to 9 p.m. Thursday through Sunday. On Fridays, year-round, the museum is open to 9 p.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday (closed April 8). Obtain pass at reception desk, main floor.

Museum Telephone: 922-9410

April
1977

Field Museum of Natural History Bulletin



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CONTENTS

6 **Tutankhamun and the Fall of the Eighteenth Dynasty**
By William J. Murnane

18 **Field Briefs**

back cover **April and May at Field Museum**
Calendar of coming events

COVER

Outside front cover: Floral perfume vase from the tomb of Egyptian king Tutankhamun, discovered by British archaeologist Howard Carter in 1922. The vase will be on view at Field Museum, together with other treasures from Tutankhamun's tomb, April 15 to August 15. An extraordinary feat of stone cutting, the vase and base with their intricate handles are formed of only two pieces of alabaster joined together. Tied around the neck are the papyrus plant of Lower Egypt and the lotus of Upper Egypt, representing the unification of the two lands. The support has a repeated motif of an *ankh,* meaning life, with outstretched arms holding the hieroglyph for dominion. Alabaster with pigment. Height 50.17 cm. Photo by Lee Boltin; courtesy the Metropolitan Museum of Art.

Additional artifacts from the tomb of Tutankhamun are shown on pages 4, 5, 8, 9, 12, 13, 16, and 17.

Costs for organizing the "Treasures of Tutankhamun" exhibit are being met in part by a grant from the National Endowment for the Humanities, matching grants from Exxon Corporation and the Robert Wood Johnson Jr. Charitable Trust. All costs of installation of the exhibit in Chicago are being paid for by the participating institutions: Field Museum and the University of Chicago.

Inside front cover: Howard Carter opening the door of the second shrine. Photo by Harry Burton; courtesy the Metropolitan Museum of Art.

Inside back cover: Howard Carter (second from left) removing the roof section of the first shrine. Photo by Harry Burton; courtesy the Metropolitan Museum of Art.

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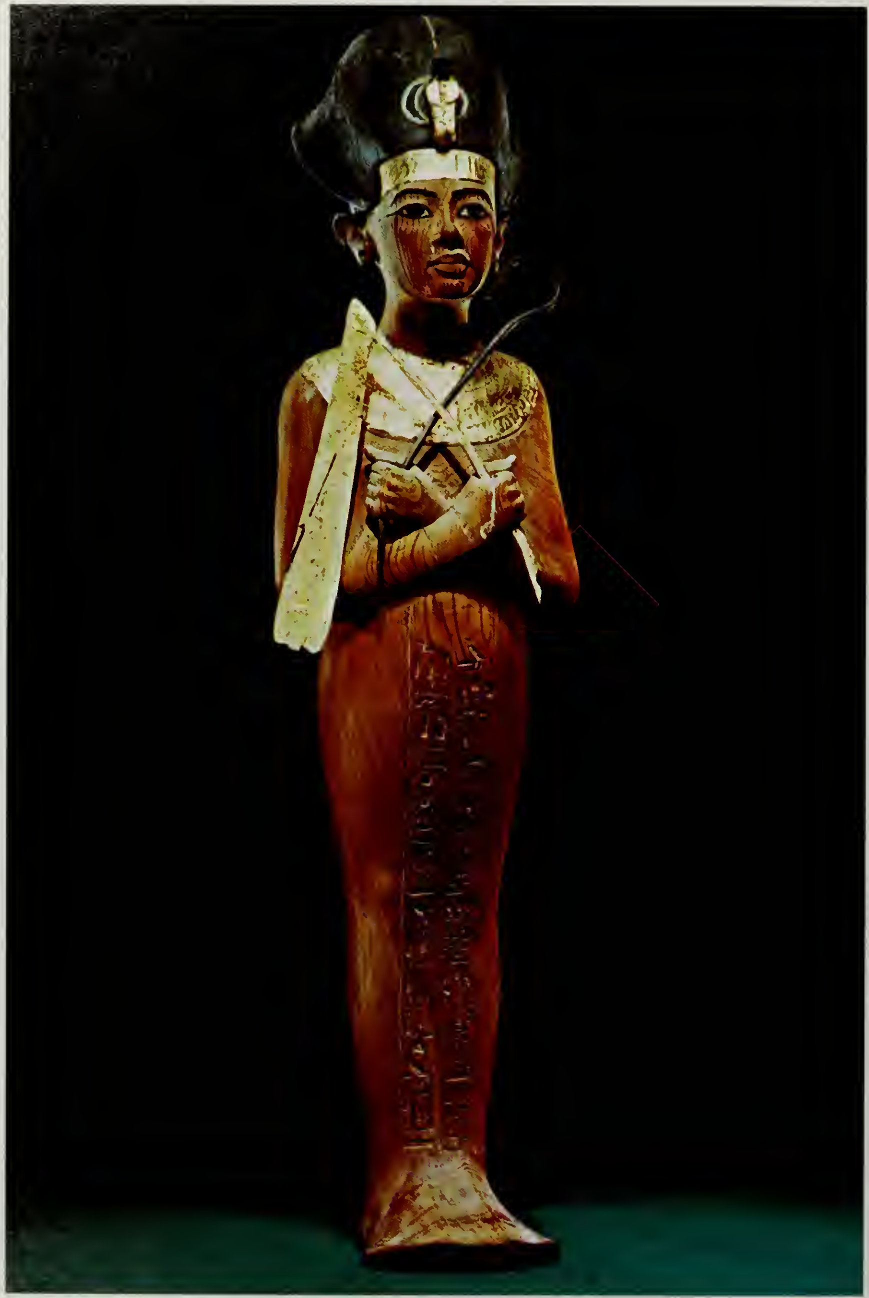
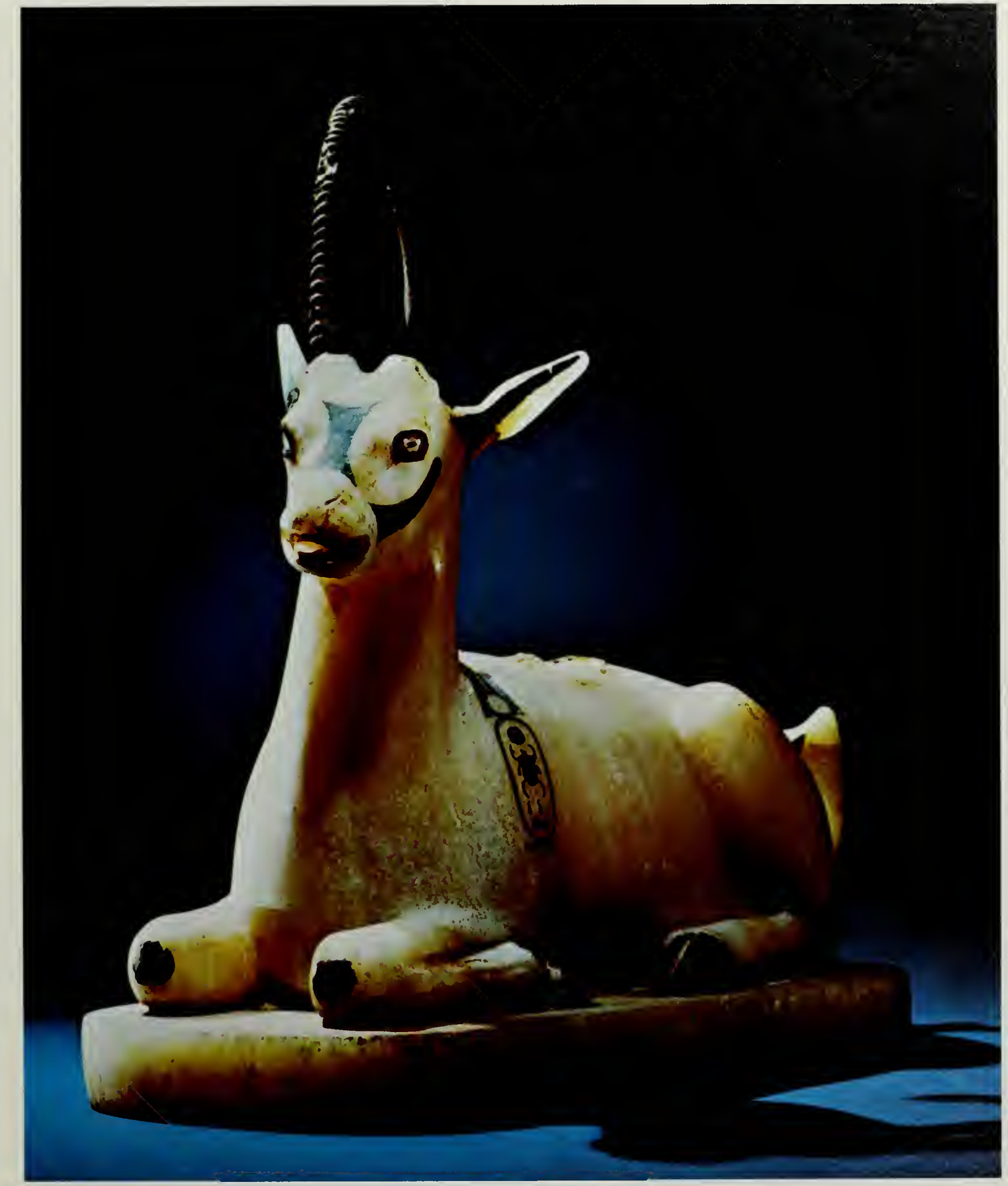




Tutankhamun and the Fall of the Eighteenth Dynasty

By William J. Murnane

The "Treasures of Tutankhamun" exhibition rekindles some of the public fascination that the discovery of his tomb engendered more than half a century ago. The story of how a royal burial was recovered nearly intact after three millennia is indeed one of the great romances of Egyptology, but amid all the publicity and attention lavished anew on the treasures, there is good reason to fear that "King Tut" himself may not receive his full share of the limelight.

Tutankhamun presided over a period that marked his country's reemergence from a period of crisis. The crisis pivoted around the crown's struggle to preserve itself against three power elites: the army, the civil service, and the priesthoods. It was by means of these three groups that the pharaohs of the Eighteenth Dynasty had ruled Egypt. Earlier rulers had kept a tight hold on power by being directly involved with all branches of government, particularly the army; and royal control over patronage theoretically allowed those earlier rulers to dominate the three groups. By the earlier fourteenth century, however, some of these controls were breaking down: peaceful relations with the other middle eastern superpowers eliminated the need for the king to campaign at the head of his army, and the independence of the royal house was increasingly compromised by the alliances it formed with its subjects, such as Amenhotpe III's highly publicized marriage into a provincial military family early in his reign.

The most visible rivals at that time were the priests. Traditionally, the pharaoh was the sole representative for worshipping the gods for his people. Priests, however, often functioned for him in this role and were also the intermediary between the people and their king. When the gods were invested as official sponsors of a successfully aggressive military policy early in the Eighteenth Dynasty, the enrichment of the priesthood was accelerated. By the time of Amenhotpe III, the most conspicuous of the priesthoods was that of the god Amun, or "Amun-Ra, King of the Gods." The temple of Amun at Karnak was the apex of a vast financial empire consisting of land, manpower, and treasure, and Amun's priests exercised a powerful influence over much of the populace. Amun's high priest, moreover, functioned as the overseer of the priests of all the other gods of Egypt, with an authority that extended well beyond his normal responsibilities. It was only a matter of time before the king would have to deal with this high priest and other overmighty subjects.

The explosion that followed has been described many times: the estrangement from Amun by Amenhotpe IV—Amenhotpe III's successor—and his espousal of a new cult centered on the sun's disk (the "Aton"); the changing of Amenhotpe IV's name to Akhenaton and the moving of his capital from Thebes in Upper Egypt to Amarna in Middle Egypt; and his attempt to suppress the priesthood of Amun, as part of an overall scheme to reaffirm the crown's preeminence.

◄ Page 4: *Shawabty for the king. A shawabty was meant to act for its owner when asked to perform duties in the afterlife. Typical shawabties are simply generalized, mummiform images; the individual quality of the face here, possibly a portrait of Tutankhamun, is rare. The finely carved statuette is inscribed as a gift from the general of the army, Minnakht. Wood, gold leaf, pigment; height 38.4 cm.*

◄Page 5: *Vase in the form of an ibex. This vase was fitted with real ibex horns, only one of which remains. The glass eyes and red-stained ivory tongue further enhance the animal's realism. A cosmetic or perfume had been placed in the hollowed-out body through an opening in the back. Alabaster, ivory, horn, glass, copper or bronze, pigment. Height 27.9 cm.*

Photos by Lee Boltin; courtesy the Metropolitan Museum of Art.

William J. Murnane is a research associate of the Oriental Institute.

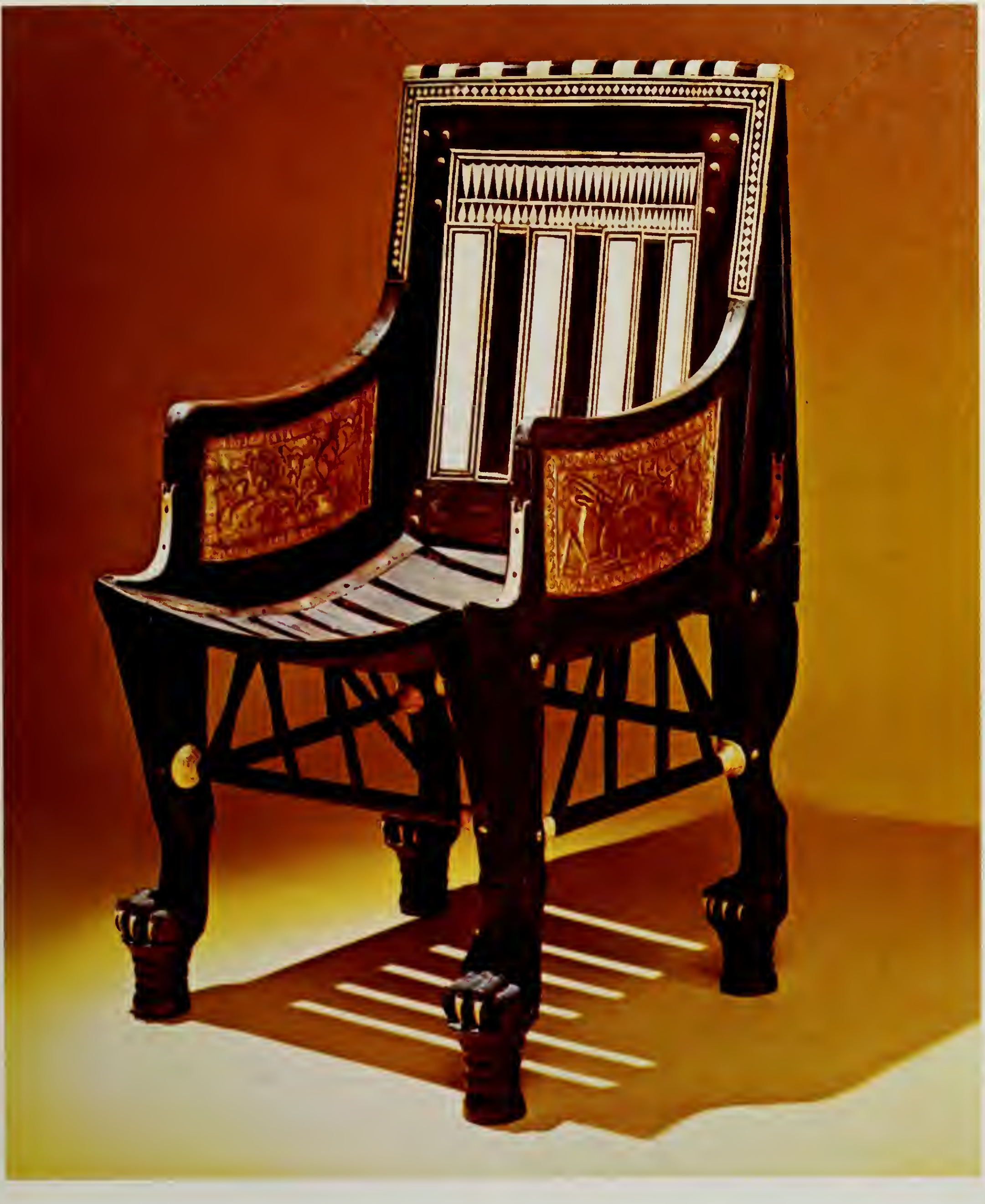
It was into this historical context that Tutankhamun was born (about the eighth year of Akhenaton's reign, *c.* 1343 B.C.). Tutankhamun's name was not originally prefixed to that of Amun, but to that of the Aton: thus, we first hear of him as Tutankhaton ("Living image of the Aton"). The fragmentary inscription from Amarna that preserves his name also tells us that he held the title "king's son of his body," but the name of the father is not given and the early years of Tutankhamun and his elder brother Smenkhkara are virtually unrecorded. Later, as king, Tutankhamun would formally refer to his "father" Amenhotpe III, a filiation accepted by many scholars, especially those who believe that Akhenaton (Amenhotpe IV) and Amenhotpe III were coregents for as long as eleven years. The same "father" term may also be translated as "forefather," a frequent usage in Egyptian. Tutankhamun and his brother could have been Akhenaton's sons by a minor wife—a woman kept in the background for much of the king's reign because of his closeness to Nafertiti, his chief queen, and to her own six daughters. Although Tutankhamun's actual paternity does remain in question, it is certain that he and Smenkhkara were in line for the throne by right of birth.

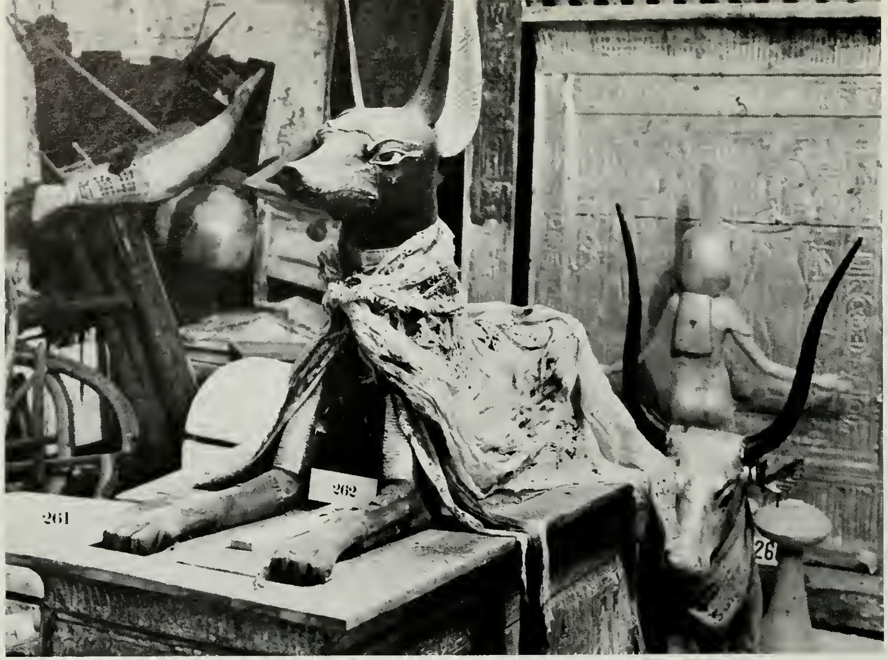
During Tutankhamun's boyhood, the position of the royal house became steadily more embattled. Akhenaton's reforms were unpopular, a situation that was aggravated by his violent raction to any opposition. By the time Akhenaton died—probably during the seventeenth year of his reign—he had left Smenkhkara, his sometime coregent and now successor, in a very delicate position. Akhenaton's legacy could not easily be repudiated by one whom he had, after all, raised to the throne; but some accommodation had to be reached with the dispossessed supporters of Amun. From what we know of Smenkhkara's reign, it seems that he attempted a strategic retreat—quietly burying the more objectionable of Akhenaton's official acts while salvaging the essence of the new ideology; but Smenkhkara died too soon to see it through. Upon his death (*c.* 1334 B.C.), his younger brother Tutankhamun, the last surviving male of the Eighteenth Dynasty line, became king.

The new king assumed as his royal names Nebkheprure ("Lord of Manifestations is Ra") and his personal name, Tutankhaton ("Ruler of Southern Heliopolis [Thebes]"). Closely associated with him during his first years on the throne were two women: Akhenaton's Queen Nafertiti, who seems to have briefly reentered the limelight, and Ankhesenpaaton, Akhenaton's third daughter. The latter emerged now as Tutankhamun's chief queen. Tutankhamun seems to have occupied Akhenaton's capital at Amarna for several years after becoming king and, during this time, he may well have continued Smenkhkara's cautious policy of appeasement, perhaps even acknowledging the cult of Amun within the very confines of Amarna. But half-measures were no longer feasible, especially since Tutankhamun's senior advisers probably favored more drastic policies. The subsequent change was sudden and public: in his fourth year, or thereabout, the king was pressured to change his hame from Tutankhaton to Tutankhamun. Likewise, his queen Ankhesenpaaton, was to be called Ankhesenamun; at the same time, the court returned to Thebes. The way was now clear for undoing all the ill that Akhenaton had wrought, and though serious persecution of his memory did not begin at least until later, during the reign of Haremhab (1321-1293), Akhenaton's legacy was not totally ignored.

Entrance to the tomb of Tutankhamun

Photo by Harry Burton; courtesy Metropolitan Museum of Art.





The jackal-headed god Anubis guarding the entrance of the treasury beyond Tutankhamun's burial chamber. Behind Anubis stands the gilded wooden shrine housing Tutankhamun's mummified internal organs, with a figure of one of four goddesses guarding each of the four sides of the shrine.

Photo by Harry Burton; courtesy Metropolitan Museum of Art.

Closely connected with this reaction is Tutankhamun's most outstanding achievement: his restoration of the great religious endowments to the status they had enjoyed before Akhenaton. The restoration program was undoubtedly forced on Tutankhamun, but his official sponsorship earned him the priests' gratitude and probably contributed to the splendor of his burial. The proclamation of their gratitude, preserved on two damaged stelae, states that the king

> *arose [upon the] Horus-[throne] of the [liv]ing, like his father, Re, every day . . . (being) a good ruler who performs benefactions for his father(s), all the gods, having restored what was ruined (to be) a monument for the length of eternity and having repelled evildoers throughout the Two Lands (=Egypt).**

The bland official prose goes on to describe the disastrous situation that faced Tutankhamun at his accession. The literary form of this passage, though stereotyped, is probably not far from truth:

> *When His Majesty arose as king, the temples of the gods and goddesses from Elephantine [down] to the marshes of the Del[ta we]re . . . , [having fal]len into decay. Their sh[ri]nes had fallen into ruin, having become mounds overgrown with w[ee]ds (?), their sanctuaries were like something that did not exist, their halls were a trodden path. . . . The gods were ignoring this land. If one se[nt an arm]y to Djahy (Syria) in order to widen the borders of Egypt, no success of theirs came to pass. If one prayed to a god to ask something of him, [in] no [wise] did he come, (and) if one petitioned to a goddess in like manner, in no wise did she come. . . .*

Tutankhamun responded generously to the call. He had statues of Amun and of Ptah, the god of Memphis, fashioned out of electrum (an alloy of gold and silver, much favored by the Egyptians), lapis lazuli, turquoise, and other precious and semiprecious stones, and he increased the number of carrying poles that bore the gods' statues in processions. (Characteristically, Amun got thirteen poles to Ptah's eleven.) The other gods of Egypt

◄ Page 8: *Painted ivory chest. This elaborately inlaid chest is a technical and artistic masterpiece; its ivory reliefs are exceptionally refined in both the carving and painting. The front panel shows the king and queen hunting, while the sides and back depict running and fighting animals. The lid portrays Tutankhamun and Ankhesenamun, his queen, in a garden. The chest's overall shape is reminiscent of a shrine. Wood, gessoed and gilded, ivory, ebony, alabaster, bronze or copper, calcite, glaze, pigment. Height 53 cm.*

◄ Page 9: *Child's chair. The dimensions of this chair suggest that it was used by Tutankhamun during his childhood. Ebony, its main material, was imported to Egypt from farther south in Africa. Desert plants and ibexes adorn the gilded armrests; ivory inlay decorates the back. Ebony, ivory, gold, bronze or copper. Height 78.1 cm.*

Photos by Lee Boltin; courtesy the Metropolitan Museum of Art.

**Brackets in the translation indicate where hieroglyphs in the original text were broken or missing.*

were also accommodated according to their relative standings. Tutankhamun's decree dealt with the various cults in summary fashion, saying that the gods' images were fashioned out of electrum, their shrines rebuilt, and the divine offerings of food and other items were reinstituted. This entailed much expenditure of precious metals, as well as materials such as cloth and incense, from the royal treasury. What distinguishes Tutankhamun's restoration from other acts of royal generosity was his reinstatement of local families to the positions they had probably held before Akhenaton's revolution.

Filling such posts from old reliable families is worth noting, for it suggests what we might otherwise suspect —that Akhenaton had frequently confiscated local endowments and diverted them to the cult of the Aton under his own appointees, thus ignoring the families that had traditionally controlled these holdings. If so, Tutankhamun's restoration did much more than just continue Smenkhkara's reinstatement of the old gods. By giving local men a vested interest in provincial cult endowments, Tutankhamun was reactivating one of the normal channels of local administration; for between them, the priestly corporations and local officials—especially if they were agents of the king—controlled most of the cultivated land in Egypt, and the people who worked it. These magnates would now have a renewed loyalty to the crown that was reinstating them.

Tutankhamun, as we have said, "presided" over these policies. The state fiction of an all-conquering king was maintained to his benefit, but we know that the high officials of the army and civil government must have been the real masters of the situation. A surprising number of these officials had served under Akhenaton, and had witnessed the failure of the new order from close quarters. The most prominent among these men was an official named Ay, who, at Amarna, had been known as "overseer of all His Majesty's horses" and "true king's scribe"; his wife Tiyi was the "nurse" of (or for?) Nafertiti. It is not known whether this couple were Nafertiti's real parents or just her foster parents, but Ay's influence at court is certain. His principal title, "God's father," probably means something like "councillor," which admirably fits the position he must have held under Tutankhamun.

Another powerful personality who now emerged on the scene was the "supreme general" and later king, Haremhab. Unlike Ay, whose formal position is not defined by his titles, Haremhab's role is clearly indicated. He may have sprung from one of the military families that flourished earlier in the dynasty; he may also have served Akhenaton at Amarna as the "overseer of works at Akhetaton" (the ancient name of modern Amarna) and as "general of the Lord of the Two Lands," under the name of Pa-Aton-em-hab. If so, he would have changed his name when the official reaction set in. Under Tutankhamun he was made "supreme general of the king" and "deputy of His Majesty in the entire land." This last position, never attained by anyone under Tutankhamun's predecessors, implies a quasi-royal power throughout the Nile valley—a status that would have been impossible under a stronger monarch.

Dynasty XVIII (1570-1293)

Ahmose I	1570-1546
Amenhotpe I	1551-1524
Thutmose I	1524-1518
Thutmose II	1518-1504
Thutmose III	1504-1450
Hatshepsut	1503/1498-1483
Amenhotpe II	1453-1419
Thutmose IV	1419-1386
Amenhotpe III	1386-1349
Amenhotpe IV/Akhenaton	1350-1334
Smenkhkara	1336-1334
Tutankhamun	1334-1325
Ay	1325-1321
Haremhab	1321-1293

In Haremhab's coronation inscription, showing him with his queen, he boasts that he had been appointed "chief adviser of the land in order to make fast the laws of the Two Banks as hereditary prince of this entire land." His latter title, "hereditary prince," seems to have been the legal basis for his power, for it was later used by princes in line for the throne. Haremhab's prominence, no doubt, put him at odds with other overmighty subjects, and in the coronation inscription we are given a glimpse of this intrigue as he blandly recalls that, "when he (Haremhab) was called into the presence of the sovereign, when the palace had fallen into rage, he was able to answer the king and he satisfied him with what came forth from his mouth." We do not know whether this refers to one incident or to a frequent situation. The remarkable fact is that he could boast of it with impunity. In Haremhab's tomb (just recently discovered) he is depicted in loyalist poses before the sovereign and the fact that he chose to be buried near the northern capital at Memphis suggests that his base of operations was in that region.

Other royal officials under Tutankhamun filled a more conventional mold, such as "Overseer of the Treasury" Maya, who survived into the reign of Haremhab and who was probably responsible for resealing Tutankhamun's tomb after an attempted robbery. Another was Amenhotpe, or Huy, viceroy of Ethiopia, who was appointed by Tutankhamun. Scenes depicted on his tomb at Thebes show Huy directing tribute to Tut-

ankhamun; particularly interesting is the depiction of the negroid "Chief of Miam, Hekanefer." Hekanefer's tomb has been excavated in lower Nubia, so we know that he was a willing partner with the Egyptian administrators of his land. He held the title, "child of the nursery," making him, officially at least, one of the king's boyhood associates; Hekanefer's other functions were related to the delivery of various goods to the court. His is an interesting example of how a Nubian could be used by the Egyptians in ruling that region. Hekanefer's appearance in Huy's tomb chapel suggests cordial relations between the two. When Huy died (during Tutankhamun's reign) he was apparently succeeded by Nakhtmin, an associate of Ay of whom we shall hear more presently.

It is likely that such powerful men as Ay, Haremhab, and Nakhtmin carefully guided the boy-king. And if the king were to die without heir, what would be more logical than for one of these advisers to seek to rule in name as well as deed? This is precisely what happened after Tutankhamun's death, in his tenth regnal year, when he was about 18. The demise of the last male of the Eighteenth Dynasty line left the succession open to anyone who might wed his widow, Queen Ankhesenamun. Concurrent with the succession crisis in Egypt, the renascent Hittite empire was carving out a sphere of influence for itself in northern Syria, and Ankhesenamun looked to the Hittites in search of a husband. The "Deeds of (Hittite) King Suppiluliumma" as told by his son, King Mursili II, relates what transpired:

> *When the people of Egypt heard of the attack on Amka they were afraid. And since, in addition, their lord, Nibkhururiya, had died, the queen of Egypt . . . sent a messenger to my father and wrote to him: "My husband died. I have no son. But you, they say, have many. If you would give me one of your sons, he would become my husband. I shall never select one of my own servants as a husband! . . . I am afraid!"*

But the royal house had finally overreached itself. The Egyptian magnates would never tolerate an unknown quantity on the throne of the pharaohs, and Suppiluliumma was too suspicious to act hastily. When his son finally did set out for Egypt, he was killed, almost certainly under orders from Haremhab. Then Ay became king. Tutankhamun's young queen now vanishes from history and it is Tiyi, Ay's consort from Amarna, who is represented as his queen in the royal tomb at Thebes. It was Ay who presided at Tutankhamun's funeral, acting thus as the "heir of burial" who had primary legal claim to his predecessor's legacy.

With the rise of King Ay, the principle of hereditary succession that had restrained the magnates since Akhenaton's death suddenly collapsed. Anyone with talent, ambition, and high connections could now aspire to the supreme power, and although Ay had seized the prize, he was probably aware of Haremhab as a potential threat and rival. Haremhab is notably absent from the private donors to Tutankhamun's burial, but we find objects that were dedicated by the treasurer, Maya, and by the "royal scribe" and "general" Nakhtmin, who perhaps became viceroy of Nubia at this time. A mutilated statue of Nakhtmin refers to him as a "king's son" (abbreviation of the viceroy's title, "king's son of Kush") and as "hereditary prince," the title on which much of Haremhab's authority was based. Possibly Ay hoped to build up Nakhtmin, with his center of operations in the south, as a counterweight to Haremhab in the north; but if so, he was to be disappointed. Nakhtmin was ousted during Ay's reign and succeeded by a probable supporter of Haremhab—a man whose family continued to hold the post for several generations thereafter. Ay continued to reign at least into his fourth regnal year, and at his death the crown passed to Haremhab, the most logical candidate. Haremhab wed, or had already wed, the Lady Mutnodjme, Queen Nafertiti's sister, thus in effect marrying into the late royal family.

Haremhab's long experience in government had made itself felt, and during his reign he gave the country the stability it needed following the Amarna period. His vizier and successor, Ramesses I, reinstated the principle of hereditary kingship, and by the time the great kings of the Nineteenth Dynasty came on the scene the royal house had achieved an efficient centralized control over the several branches of government. The king appointed high officials and personally led his army into battle; a subtler policy towards the powerful priesthoods was also evolving. The king's position as Lord of the Two Lands was secure, and would remain so until towards the close

◄ Page 12: *Pair of earrings. These earrings are in the form of hybrid birds with wings and bodies of falcons and the heads of ducks. The tubes, which were inserted through enlarged piercings of the king's earlobes, end in quartz buttons. Under the transparent stones are painted portraits of Tutankhamun. Gold, colored glass, quartz, alabaster, and faience. Height 11.1 cm.*

◄ Page 13: *The god Ptah. Ptah was the principal god of Memphis, the original capital of Egypt, and was the patron of artists and craftsmen. According to his cult's mythology, Ptah created the entire world and even the other gods by uttering the name of each thing or being. Ptah is usually shown mummiform and in a skullcap; the feathered garment he wears here is most unusual. Wood, gessoed, and overlaid with gold, faience, glass, and bronze. Height 52.7 cm.*

Photos by Lee Boltin; courtesy the Metropolitan Museum of Art.

Howard Carter cleaning the third coffin of Tutankhamun.

Photo by Harry Burton; courtesy Metropolitan Museum of Art

of the eleventh century, when a combination of internal and external difficulties was to topple it.

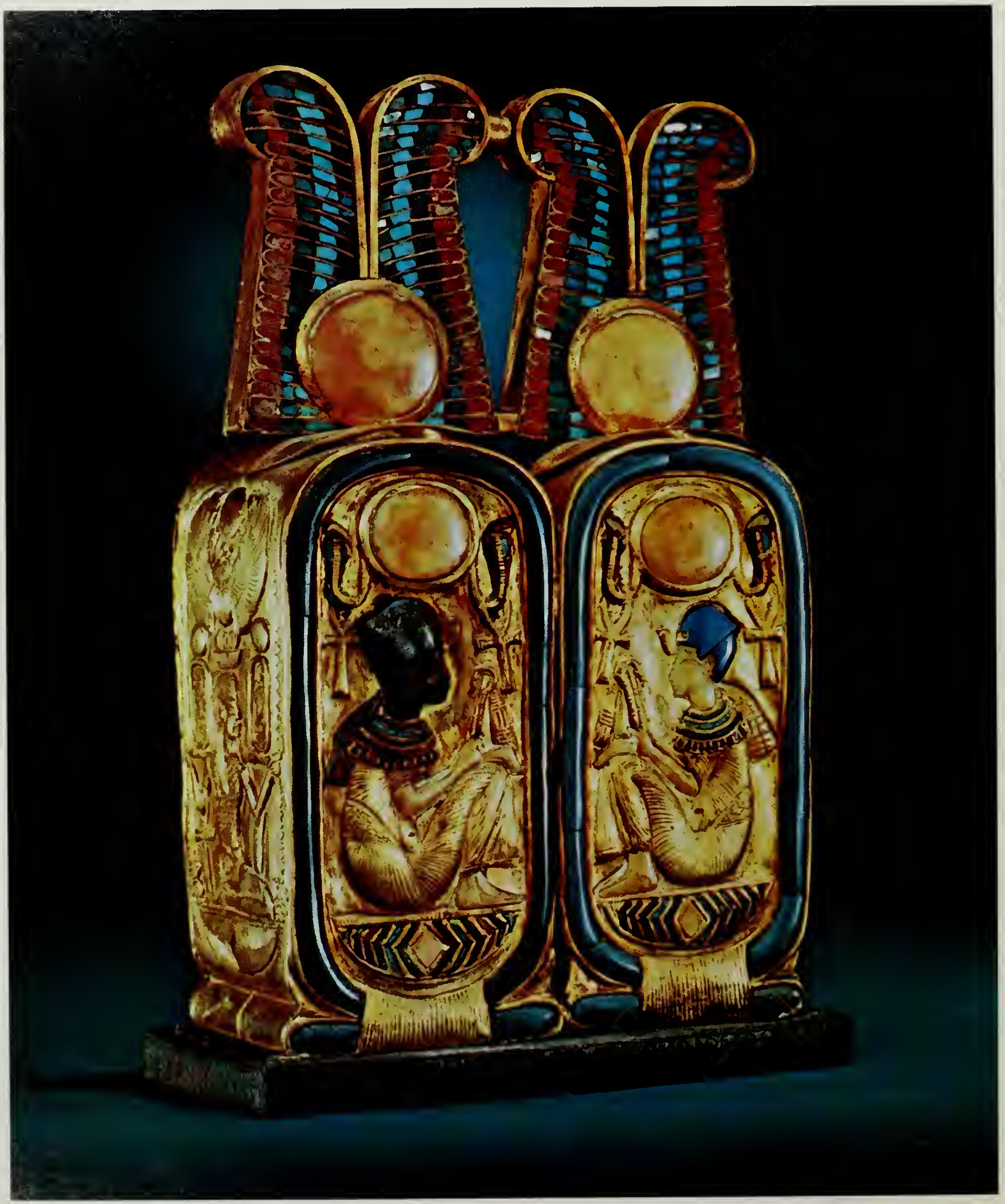
Meanwhile, the remains of Tutankhamun continued to rest in the Valley of the Kings. His official memory did not long outlast his death, for Haremhab appropriated Tutankhamun's monuments and took the credit for the pious deeds done under Tutankhamun. Yet, the boy-king's tomb was respected, for the robbers who broke in some time after the burial were apprehended and the tomb resealed. Gradually, sand and rubble accumulated over the entrance, so that when Ramesses VI's tomb was constructed almost directly above it during the twelfth century B.C., stone chippings from the new tomb were dumped on top of the now forgotten tomb, keeping it safe until Howard Carter discovered it in 1922.

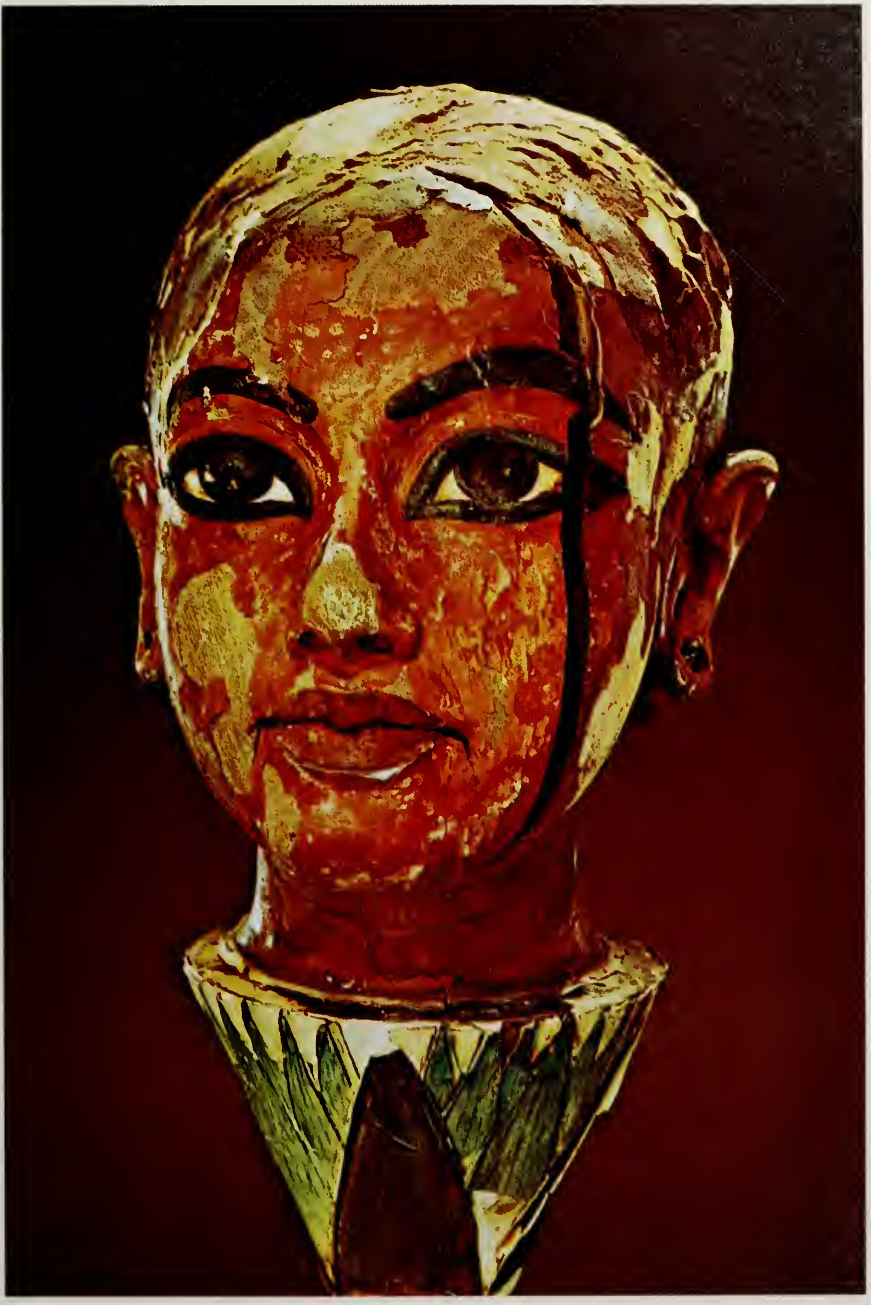
In the long run, Tutankhamun gained an immortality that may seem disproportionate to his achievements; the deeds of a Thutmose III or a Ramesses II are known to historians, but Tutankhamun's name, thanks to the splendor of his preserved treasures, lives throughout the modern world. □

Page 16: *Couble cartouche-shaped box.* ➤
This gold box, found in the bottom of the sarcophagus, has two compartments, originally filled with ointments similar to those poured over the mummy. The large cartouches contain representations of Tutankhamun as a child, seated beneath the sun's disk. Gold, colored glass; calcite or quartz silver; height 15.9 cm.

Page 17: *The sun god on the lotus. This finely carved head has the features of Tutankhamun as a child and identifies him with the sun god. According to an Egyptian creation myth, the sun god emerged from a blue lotus as the first human being. The portrait was discovered in the rubble that filled the entrance corridor. Wood, gessoed and painted; height 29.8 cm.* ➤

Photos by Lee Boltin; courtesy the Metropolitan Museum of Art.





field briefs

Third Annual Wilderness Canoe Trip

July 19-29

Applications are now open for a July canoe trip through Ontario's Quetico Provincial Park, a membership benefit cosponsored by Field Museum and the Voyageur Wilderness Program of Atikokan, Ontario.

The Quetico, just north of Superior National Forest, in Minnesota, is one of our last remaining wilderness areas. Transportation in this land of rock, pines, and glacial lakes is by muscle power only. To enjoy the unspoiled beauty of Quetico, one must earn his way in—by paddling a canoe and carrying the canoe and gear over portages, which may be from a few yards to a mile long.

The group, limited to 30 persons, will spend eight days and seven nights canoeing and camping—not fighting nature, but learning to live with it. All equipment, food, and guide services, as well as bus transportation between Field Museum and the Quetico, are included in the package. The trip is limited to Museum members 15 through 19 years old who are able to swim. Applicants will be interviewed by trip leaders, who will then select the final group.

Dates: July 19 through July 29, 1977
Total cost: $195.00
Deadline for application: May 15
Notification of participants: By June 1

A slide presentation by Voyageur representatives will be given on May 7. Information on time and location will be mailed. For applications and further information, write: Quetico Canoe Trip, Membership Department, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605.

Treasures of Tutankhamun Members' Previews April 13 and 14

A special preview of the forthcoming exhibit, "Treasures of Tutankhamun," will be provided Field Museum members on Wednesday, April 13, and Thursday, April 14, from 10 a.m. to 9 p.m.

Admission to the preview will be an invitation card, being mailed to all members. This must be presented at the entrance. The card will admit no more than two persons, a limitation imposed because of the large number of viewers expected. However, your membership card will entitle you and your immediate family to priority admission to the exhibit from April 15 to August 15.

To avoid crowds, exhibit viewers are encouraged to come early.

Weekend Geology Field Trips for Members: Starved Rock and the Baraboo Range

An overnight trip for Museum members to Starved Rock State Park, 80 miles southwest of Chicago, will take place on Saturday and Sunday, June 4 and 5, under the leadership of two Field Museum geologists: Gordon Baird, assistant curator of fossil invertebrates, and Matthew Nitecki, curator of fossil invertebrates.

The flat, horizontal rocks of central Illinois are interrupted by the spectacular upfolding of older rocks; eons ago these formations were cut into picturesque glens and canyons. Field trip participants will explore and study these formations and consider the influence they have had on the region's economy.

Field Museum Members will again have an opportunity on Saturday and Sunday, June 11 and 12, to explore Wisconsin's Baraboo Range, a field trip which was so successful last year. The trip leader will be Edward Olsen, chairman of the Department of Geology. The Baraboo Range is of special interest as a *monadnock*—what is left of an ancient mountain range and now stands above the younger rocks and sediments. The range consists of quartzite—more than one billion years old—which, although compressed into vertical folds, retains the original sedimentary structures. The mountains were further modified by glaciers, forming beautiful Devil's Lake and picturesque glens, and changing the course of rivers. Our "lecture tour" will take us through the range and along the shores and hinterland of Devil's Lake.

The Starved Rock and Baraboo Range groups will leave the Museum at 8:00 a.m. on Saturday mornings (June 4 and 11, respectively) and return on Sunday evenings between 6:00 and 7:00 p.m. The cost of each educational tour is $65 per person, which includes all expenses of transportation on a deluxe charter bus and overnight first class accommodations (Price is based on double occupancy; single accommodations extra). The fee also includes all meals and gratuities, except personal extras such as alcoholic beverages and special food service.

Hiking clothes and boots or sturdy shoes are strongly recommended for the scheduled hikes. The trip is not suitable for children, but young people interested in natural history are welcome. Each group is limited so get your reservation in early!

For further details write or call Dorothy Roder, Field Museum 922-9410, ext. 219.

Field Museum Field Trip

I wish ______ reservations for field trip to:
(how many)

☐ Starved Rock (June 4-5)
☐ Baraboo Range (June 11-12)

Name ______________________

Street ______________________

City ____________ State ________ Zip ________

Phone ____________

Amount enclosed ($65 per person) ____________
(Make check payable to Field Museum)

Return this coupon or facsimile today!

April and May at Field Museum

(From April 15 through May 15)

SPECIAL EXHIBITS

Treasures of Tutankhamun—April 15 through August 15. The long-awaited exhibit, on loan from the Egyptian government, features a dazzling display of 55 of the most beautiful and best-preserved objects from the tomb of the legendary pharaoh. Among these are the startling golden effigy of Tutankhamun, the graceful gilt statuette of the Goddess Selket, a gilded figure of the young pharaoh harpooning, and a small gold shrine of exquisite craftsmanship. The exhibit also includes superb examples of Tutankhamun's funerary jewelry, furniture, writing materials, musical instruments, games, and decorative objects of alabaster and ivory. (Cosponsored by the University of Chicago's Oriental Institute.) Monday through Wednesday, 9 a.m. to 6 p.m.; Thursday through Sunday, 9 a.m. to 9 p.m.

The Magic of Egyptian Art—April 15 through August 15. A supplementary exhibit to run concurrently with the Tutankhamun exhibit at Field Museum features artifacts from the Oriental Institute's permanent collection including objects used in the actual embalming of Tutankhamun and at his funerary banquet. Oriental Institute, 1155 East 58th Street, Chicago. Tuesday through Saturday, 10 a.m. to 4 p.m.; Sunday, 12 a.m. to 4 p.m.

SPECIAL PROGRAMS

Ayer Film/Lecture Series. This series highlights familiar and not-so-familiar areas of the world. Saturdays, at 2:30 p.m., in Simpson Theatre, ground floor.

April 16	*Chambers of the Sea* by Stanton Waterman
April 23	*America's Heartland—The Great River Story* by Walter Berlet
April 30	*Birds of Prey* by Neil Rettig

Ray A. Kroc Environmental Education Program. Beginning May 7, the museum offers its spring series of weekend environmental field trips to areas in and around the Chicago area. Watch your mailbox for your copy of the environmental field trips flyer. Advance registration is required.

CONTINUING EXHIBITS

The Place for Wonder. Visit the newly opened *The Place for Wonder* gallery. Open to visitors of all ages, this room provides a "hands-on" approach to natural history. Staffed by volunteers, it is open to the public promptly: weekdays, 1 p.m. and 2 p.m.; weekends, 10 a.m., 11 a.m., 1 p.m., and 2 p.m. Located near the new cafeteria, ground floor.

Male and Female: Anthropology Game. This game/exhibit of 38 artifacts is a great way to learn that economic and social roles of the sexes are not universally the same. South Lounge, 2nd floor. No closing date.

Man in His Environment. This exhibit takes a global view of some of the most serious environmental problems confronting all mankind and asks visitors to involve themselves in these problems—and the need for solution. Hall 18, main floor. Permanent.

CONTINUING PROGRAMS

Spring Journey for Children—*How to Read a Bird.* An activity-oriented self-guided tour through the museum's bird halls. Learn about birds: compare their beaks, their feathers, their sizes and shapes. Families will enjoy Journeys too. Journey sheets are available at the information booth.

Weekend Discovery Programs. Saturdays and Sundays, 10 a.m. to 3 p.m.: take tours, follow demonstrations, participate in museum-related activities.

The Ancient Art of Weaving. Members of the North Shore Weavers' Guild demonstrate weaving and spinning every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

SPECIAL-INTEREST MEETINGS OPEN TO THE PUBLIC

April 17, 2:00 p.m.	**Chicago Shell Club**
April 19, 7:30 p.m.	**Chicago Audubon Society**
May 3, 7:30 p.m.	**Kennicott Club**
May 5, 7:00 p.m.	**The Primitive Arts Society**
May 6, 8:00 p.m.	**Chicago Anthropological Society**
May 10, 7:30 p.m.	**Chicago Nature Camera Club**
May 11, 7:00 p.m.	**Chicago Ornithological Society**
May 11, 7:30 p.m.	**Windy City Grotto, National Speleological Society**
May 12, 8:00 p.m.	**Chicago Mountaineering Club**

MUSEUM HOURS NOW THRU AUGUST 15

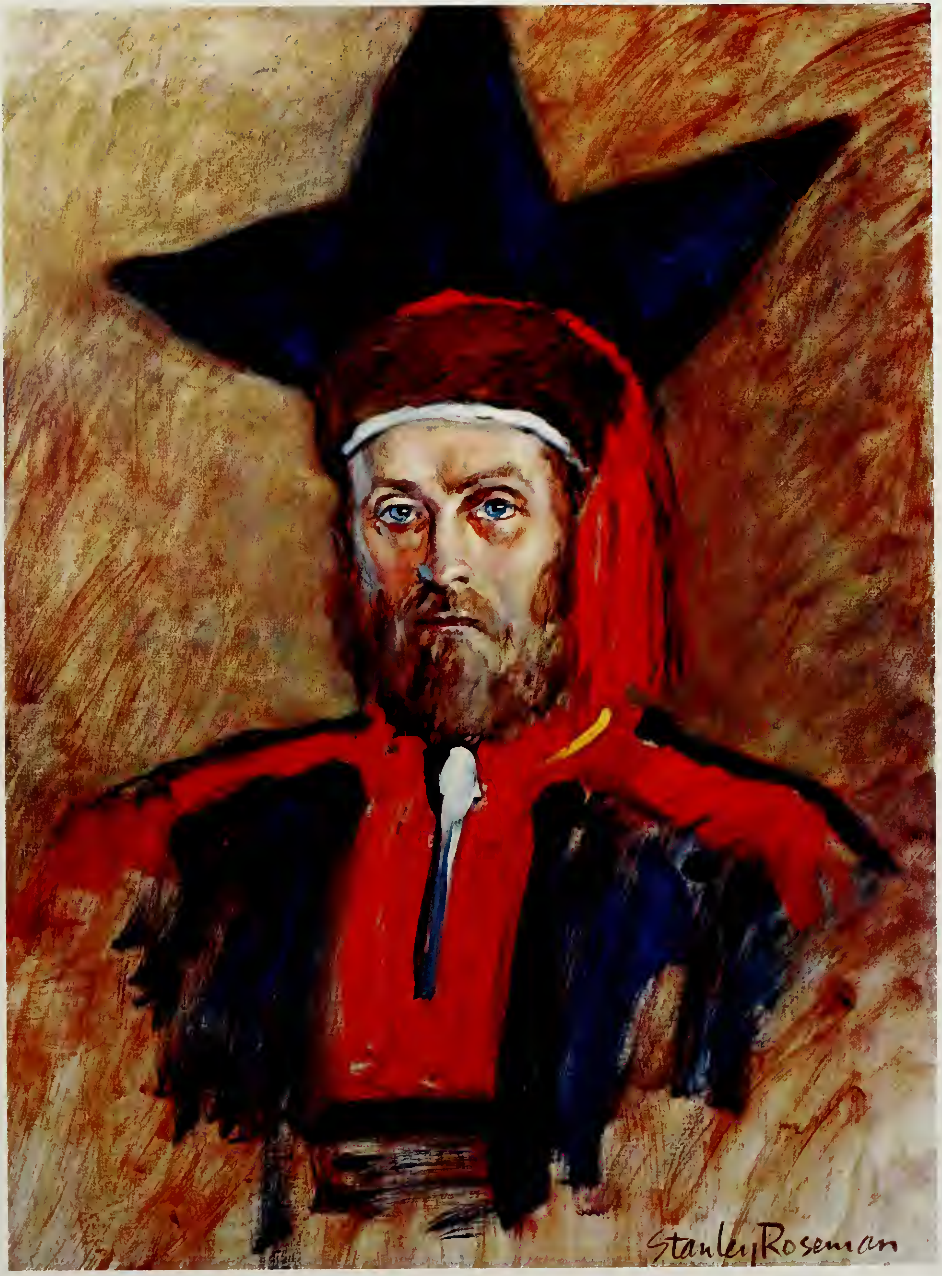
The Museum Opens daily at 9 a.m., closes at 6 p.m. Monday through Wednesday and 9 p.m. Thursday through Sunday. On Fridays, year-round, the museum is open to 9 p.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday. Obtain pass at reception desk, main floor.

Museum Telephone: 922-9410

May
1977

Field Museum of Natural History Bulletin


Stanley Roseman

Field Museum of Natural History Bulletin

May, 1977
Vol. 48, No. 5

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Field Museum of Natural History
Founded 1893

President and Director: **E. Leland Webber**

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CONTENTS

3 **Field Briefs**

6 **On Coming and Going in Saamiland**
By Myrdene Anderson
Paintings by Stanley Roseman

12 **Tigers without Their Stripes**
By David M. Walsten

14 **Letters from Antarctica III**
By Edward Olsen, curator of mineralogy

22 **Volunteers Honored**

back cover **May and June at Field Museum**
Calendar of coming events

COVER

Regnor, a Saami, or Lapp, of east Finnmark, a far northern county of Norway. Life-size oil painting by Stanley Roseman, New York City artist. In 1976 Roseman spent several weeks in northern Norway doing portraits of the Saami, several of which are reproduced in this issue. See "On Coming and Going in Saamiland," by Myrdene Anderson, p. 6. Regnor wears the traditional costume of east Finnmark.

Cover photo by Manu Sassoonian

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Field Briefs

Ferdinand Huysmans Succumbs

Ferdinand "Fred" Huysmans, Field Museum's scanning electron microscope (SEM) technician, died recently after a brief illness; he was 64. Huysmans came to Field Museum in 1961 as assistant photographer and in 1974 he became the Museum's first SEM technician. He soon developed a reputation for his thorough craftsmanship and technical expertise. In September of last year Huysmans was awarded a certificate of commendation by the Royal Microscopical Society, Oxford, England, for his SEM photograph of a pollen grain (reproduced on cover of September 1976 *Bulletin*).

Born in Bogor, Java, in 1912, Huysmans was a photographer's apprentice for a time in the Netherlands, then returned to Java as head of the photographic studio of the Botanical Gardens in Bogor. Later he worked as a photographer in Leiden, the Netherlands. He came to the United States in 1960 and at the time of his death was a resident of Arlington Heights, Ill. He is survived by his wife, Adeline, and two daughters.

Anthropology Internship Program

Do you hear it? Opportunity is knocking for advanced undergraduates and early graduate students currently working toward a degree at an accredited college or university.

Internship curatorial and research applications for appointments in the Department of Anthropology for 1977-78 are now being considered by the Center for Advanced Studies at the Field Museum. In this program, student interns and staff members in the anthropology department are jointly involved in a one-to-one learning experience in which the students participate in projects built around museum collections or the research activities of the scientific staff. By mutual agreement between student and supervisor, each student is made individually responsible for the final design and implementation of a curatorial project and for completing an appropriate report or museum undertaking.

An intern can select either research or curatorial activity. Research—theoretical as well as applied—may be concerned with any aspect of anthropology, human geography, ethnology, biological anthropology, or archaeology. A chosen project must meet with the approval of the center as well as both supervisor and intern. Curatorial projects may be related to any aspect of museum work and administration, including exhibits planning, conservation, collection management, computer data banking, and exhibits research.

These internships require full-time work at Field Museum for six months. In exceptional cases, applications for a three-month appointment will be considered. Accepted interns will receive a monthly stipend of $300 and up to $240 for round-trip travel expenses.

Applications for fall 1977-winter 1978 internships must be postmarked no later than July 1, 1977; applicants will be notified of results by early August. Appointments should commence prior to October 4, 1977.

Internship applications and essay forms may be obtained by writing Dr. John Terrell, Center for Advanced Studies, Field Museum of Natural History, Roosevelt Rd. at Lake Shore Dr., Chicago, Il. 60605.

This internship program is supported by a grant from the National Endowment for the Arts.

Antonio Molina Honored

Antonio Molina, a field associate in botany since 1963, has recently been honored by the government of his native Honduras. The Honduras Ministry of Public Education, in awarding national prizes in science, art, and literature, selected Molina for the coveted science prize.

Molina is associate professor of botany at Escuela Agricola Panamericana, Tegucigalpa, Honduras, where he is also curator of the herbarium. He collaborated with Louis O. Williams, past chairman of Field Museum's Department of Botany, in writing the treatment of the family Juglandaceae for the Flora of Guatemala which was published in *Fieldiana: Botany* in 1970. Molina has also collected several thousand plant specimens now housed in Field Museum's John G. Searle Herbarium.

Most Important Collection of North American Indian Art Ever Assembled to Be Subject of Members' Tours

"Sacred Circles—2,000 Years of North American Indian Art" is the title of an art exhibit now on view in Kansas City, Missouri, and which will be the subject of three June tours for Field Museum members. Two separate, all-day trips will be made by air to Kansas City on Wednesday, June 1, and on Sunday, June 5; a third, overnight trip, by air, will leave Chicago on Saturday, June 11 and return the following day. The 850-piece exhibit is to be seen at Kansas City's Nelson Gallery-Atkins Museum of Fine Arts. The only other showing for this magnificent array of art and artifacts opened last October for three months at London's Hayward Gallery, where it drew nearly 200,000 viewers.

The exhibition represents a wide diversity of Indian culture over a 2,000-year period, with artifacts from Alaska to Florida, Maine, and California. Some 90 museums (including Field Museum) and individuals in six countries have loaned the exhibited materials. Guest lecturer for the three trips will be Harriet Smith, a Field Museum Department of Education staff member since 1947. A past president of the Chicago Archaeological Society, Miss Smith has written and lectured extensively on the archaeology of midwestern Indians; she has also participated in archaeological digs, notably at Murdoch Mound (Cahokia, Ill.), where she was director of excavation.

➤

Howard Carter, left, prepares treasures for removal from Tutankhamun's tomb (1922). Photo by Harry Burton; courtesy Metropolitan Museum of Art

Field Museum Kansas City Tour

I wish ________ reservations for tour on:
(how many)

☐ June 1 ($157.00)
☐ June 5 ($157.00)
☐ June 11-12 ($181.00 per person double occupancy; $197.50 single)

Name ______________________________

Street ______________________________

City ____________________ State __________

Zip ________

Phone ________________

Amount enclosed ____________________
(Make check payable to Field Museum)

Return this coupon or facsimile today!

The cost of the June 1 and June 5 trips is $157.00 per person; the overnight trip of June 11-12 is $181.00. The fee includes round trip air fare, coach class, including tax and security charges (air fare subject to change); round trip limousine transfer between airport and museum; sandwich lunch at the Atkins Museum and dinner on return flight; taxes and gratuities (except at Kansas City's Hotel Alameda) and entrance fees; guidance by tour lecturer from Chicago; and (for June 11-12 trip) accommodations at Hotel Alameda, single supplement $15.60.

Reservations may be made by sending coupon printed here (or facsimile) together with full payment to Dorothy Roder, Membership Department, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. For further details Mrs. Roder may be phoned at 922-9410, ext. 219.

Tutankhamun Treasures Now on View

In the above photo, British archaeologist Howard Carter is shown in the tomb he had located not long before, in 1922. Fifty-five of the priceless treasures he discovered, now on loan from the government of Egypt, went on exhibit at Field Museum on April 15 and will continue to be on view daily until August 15, from 9 a.m. to 6 p.m. Monday through Thursday and 9 a.m. to 9 p.m. Thursday through Sunday.

Concurrent with the exhibit at Field Museum, the University of Chicago's Oriental Institute (1155 E. 58th St.) is exhibiting "The Magic of Egyptian Art," featuring objects from the institute's permanent collection that were used in the actual embalming of Tutankhamun and at his funerary banquet. Also on display are examples of ancient

Egyptian writing, religious objects, and portraiture. The entire collection of Tutankhamun's embalming and banquet material and most of the thirty-seven pieces that comprise the exhibit have never before been on public view.

"The Magic of Egyptian Art" is free to the public. Oriental Institute museum hours are 10 a.m. to 4 p.m. Tuesday through Saturday, and 12 noon to 4 p.m. Sunday.

Charles F. Davis Book Honored

Harvest of a Quiet Eye: The Natural World of John Burroughs, by Charles F. Davis, Field Museum nature photography instructor, was recently named among 10 winners in the 21st Annual Midwestern Books Competition. The award was made on the basis of typography, design, and quality of production. The book, published by Tamarack Press, Madison, Wisconsin, combines the writing of naturalist John Burroughs with Davis's sensitive color photographs. *Harvest of a Quiet Eye* may be purchased at the Field Museum shops. $20.00 (less member's 10% discount).

Ellen Thorne Smith

With the death of Ellen Thorne Smith on March 16, 1977, Field Museum lost one of its warmest friends and most dedicated supporters. During her forty years' association, her interests encompassed the whole Museum, whether she was working as a volunteer in the Bird Division, as president of the Women's Board, or as trustee. Even more important to Ellen than the institution were the individuals with whom she came in contact, for above everything else she loved people.

Ellen's first relationship was with the Division of Birds in 1936, when Rudyerd Boulton, then curator, accepted her offer to work as a volunteer. She soon proved to be the epitome of the volunteer—enthusiastic, willing to do any task no matter how tedious, and regularly present three to five days a week. Her desire was to free the time of the curators for research, and as her knowledge and skills increased, she graduated from cataloging to rearranging parts of the collection, and to identifying and processing incoming specimens. The culmination of her scientific work was the publication of "Review of *Pionus maximiliani* (Kuhl)," in the Museum scientific series, *Fieldiana*. Her abilities were the salvation of the Bird Division during the war, for by 1943 curators Boulton and Emmet Blake were gone, and Ellen was the sole staff, handling all correspondence, processing loans, and caring for the collection through 1945.

Ellen Thorne Smith

Besides her general help to the Bird Division, Ellen carried through several projects on her own. She wrote *Chicagoland Birds, When and Where to Find Them*, which was published by the Museum in 1958, and revised it for a second edition in 1972. She planned and supervised the preparation of the exhibit *Resident Birds of Chicago*, selecting with equal care the birds and the plants that accompany them. When the opportunity arose to exchange North American birds for an authentic specimen of the long-extinct great auk, Ellen personally selected the 1,900 specimens that were sent to Brussels. Her final major contribution to ornithology was to take the measurements of long series of all the ducks and geese of North America, for inclusion in volumes 2 and 3 of the *Handbook of North American Birds*. This task entailed not only endless hours at Field Museum, but extended visits to museums in New York and Cambridge as well.

In 1966 Ellen was asked to lead the formation of a women's board of the Museum. She accepted the challenge and set about her new responsibilities with her usual thorough and pragmatic effectiveness. The sound early course that she set for the Women's Board has resulted in an organization that has, in its eleven years, become central to the well-being and strength of Field Museum.

She was elected the first woman trustee of the Museum in 1969 and in the ensuing seven years her dedication and wise counsel was brought to bear in still other dimensions of the institution, at board meetings and as a member of the Program Planning and Evaluation Committee and the Resource Planning Committee.

But even after Ellen's activities extended to the Museum as a whole through the Women's Board and the Board of Trustees, she maintained her connection with the Bird Division. Every Members' Night saw her manning the special bird display, where her particular pleasure was instructing and entertaining the children. Her warm affection for and interest in people of all ages shone from her clearly, and it was reciprocated by all who knew her.

Ellen Smith was one of the great builders of Field Museum. Such lives are seldom seen, but when that near-unique combination of commitment and talent is brought to bear in an institution, that institution and those who are a part of it are singularly blessed.

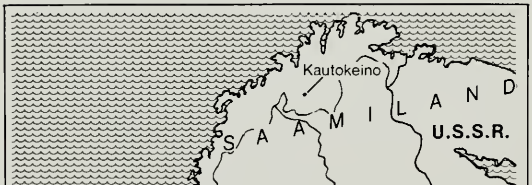
—M. A. T., E. L. W.

On Coming and Going in Saamiland

By Myrdene Anderson
Photos by the author

With paintings by Stanley Roseman

Photographs of paintings by Manu Sassoonian



FENNOSCANDIA

Northernmost Fennoscandia, surely one of earth's least hospitable lands, has been home for the past few millennia to the Saami, or Lapps, a society of highly mobile people who have retained much of their cultural identity up to the present time. The region they occupy today—roughly the size of the state of Montana—cuts across the borders of Norway, Sweden, Finland, and the U.S.S.R. Today most Saami live in Norway; relatively few reside in the Soviet Union.

The Saami language, spoken by some 35,000, is placed in the Finno-Ugric group and most closely resembles Finnish, Hungarian, Estonian, and several rather obscure tongues spoken in northwestern U.S.S.R. About 15,000 persons who speak no Saami, but only the national language in the country where they reside, nevertheless regard themselves as Saami. The total number of Saami would be increased severalfold were we to include those who have been assimilated into national cultures, either through mixed marriages with non-Saami or by other reasons of choice.

Whatever population criteria are used, the Saami have never been numerous, and their numbers have decreased over the past century. However, most residents of Fennoscandia north of the 62nd parallel are thought to have some Saami ancestry. It is also likely that some Americans whose forebears came from Fennoscandia may be Saami or part Saami—a fact early obscured as the newcomers to America identified their origins only by nationality.

The geography and its relevance

My personal experience with the Saami began in 1972, in the township of Kautokeino, or Guov'dageai'dno, located in Norway's Finnmark County, just north of the 69th parallel. It was here that I lived with the Saami for nearly five years doing anthropological research on their folk natural science. Although I had at first sought to concentrate on the folk botany and folk zoology of these people, I soon found myself equally intrigued by their concepts of time and space, geography, and meteorology. All are of primary importance to a mobile, even nomadic, people situated in a region of minimal biological stimuli—that is, an environment with relatively few plant and animal species.

Most of the Kautokeino region has snow cover eight or nine months of the year. During this period of short daylight hours, only a few species of trees and large shrubs are visible in the broad white expanse of the inland area where the reindeer spend the winter. The summer pasturage along the coast, on the other hand, has a rela-

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Myrdene Anderson is a graduate student in anthropology at Yale University.

Saami folk, resplendent in smiles and traditional costume, chat outside church following confirmation service. The state church in Norway is Evangelical Lutheran, and Saami attend church as well as Laestadian Sect meetings, the latter being held in state churches, in private homes, or other secular buildings.

tive abundance of herbaceous plants, but most Saami are so involved in routine moving about during the summer that they have little opportunity to develop an interest in the flora.

The population and the economy

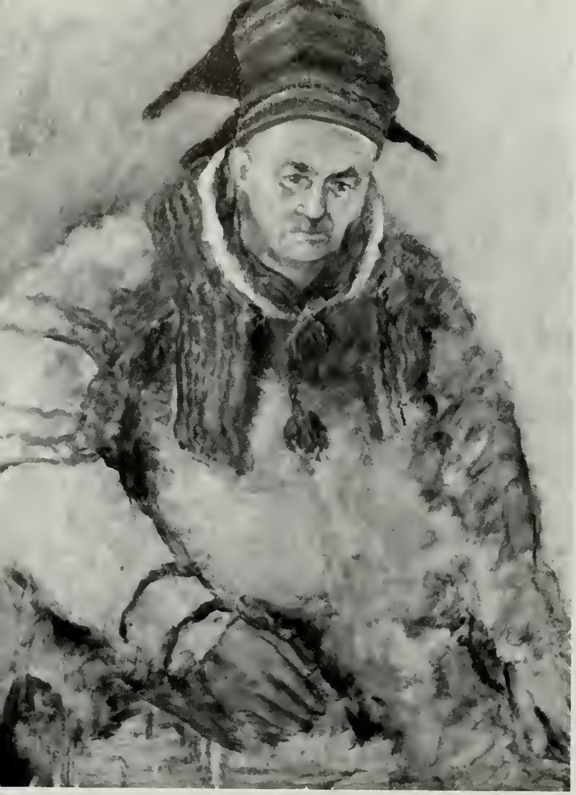
Kautokeino township, with an area of 3,800 square miles (twice the size of Delaware), has some 2,800 inhabitants. About 90 percent speak Saami, and nearly 40 percent are engaged in reindeer management (which, by law, is the sole privilege of the Saami in Norway). The rest of the local Saami are mostly dairy farmers or are engaged in sheep-raising, hunting, trapping, or fishing; the entire population derives some income from tourism, and about 5 percent of the working population is engaged full-time in this occupation.

During the summer months, in particular, tourists from all over the world and numbering several times the local population visit Kautokeino, one of the main cultural centers of the Saami. Here they see the colorful native dress, observe the midnight sun, and experience the pleasures of fishing and hunting in Europe's last wilderness. But there is a growing articulate minority among the Saami who object to tourism, and who feel that their natural resources of land, water, and productive species are so limited that even neighboring Saami should be excluded from their use.

Saami attitudes on mobility

A significant trait that the Saami have in common with their visitors—be they tourists, journalists, researchers, or neighbors—is their mobility. Moreover, they have a unique affinity for persons who are always "on the go," especially if the orbits of such persons intersect with their own. The most mobile Saami are the reindeer-raising families of the inland areas. The men who live along the coast and who are employed as fishermen or as seamen are mobile in quite a different way, being at sea for months at a time. Traditionally the farm workers, culti-

(text con't on p. 10)



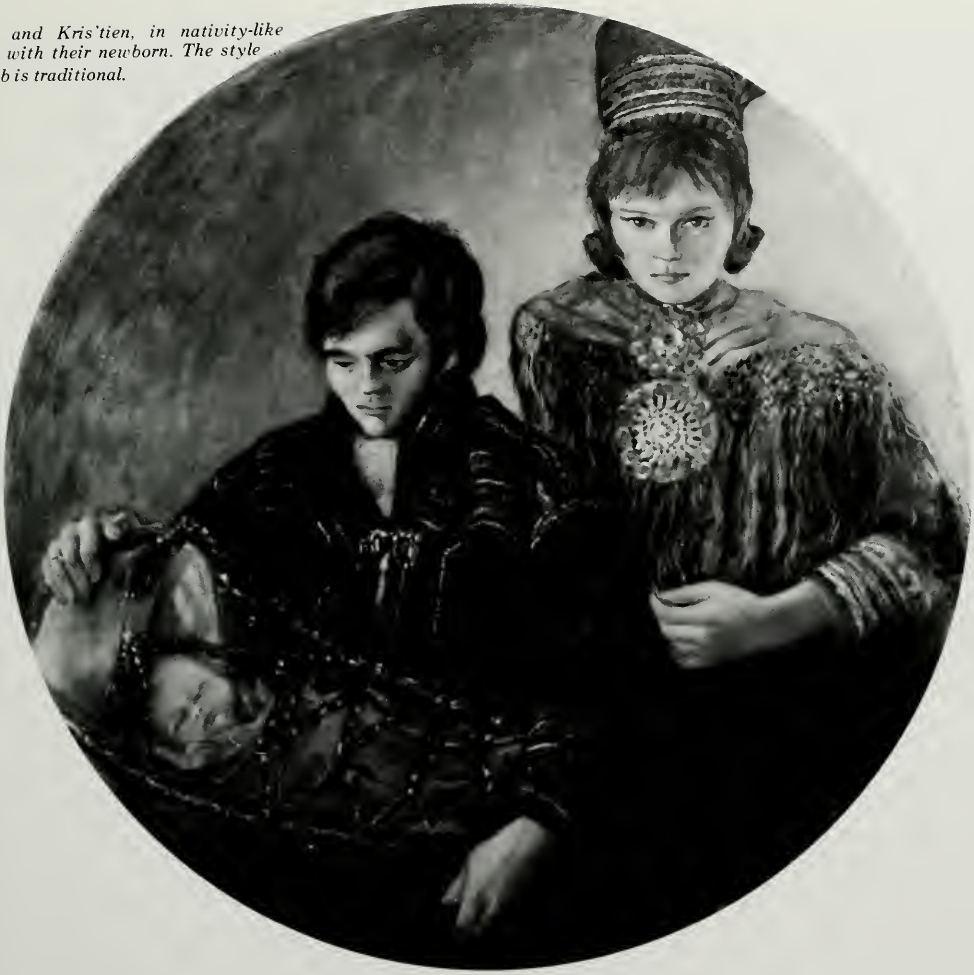
Perhaps more than any other indigenous minority in Europe, the Saami have been able to retain their cultural identity. They have their own language, a distinctive dress, and a highly individual lifestyle; a number of them continue to live as nomads, following the reindeer in their seasonal migrations. Not surprisingly, Saami society has been the object of scrutiny by specialists in various aspects of human culture, but little has been published about them in the lay literature.

Quite recently, however, scientist-humanist-at-large Jacob Bronowski devoted a segment of his widely televised film series "The Ascent of Man" to the Saami. Among the millions who viewed Bronowski's documentary was New York artist Stanley Roseman, who was so intrigued that he packed his painting gear and flew last September to Norway. In Kautokeino, Finnmark County, he spent several weeks creating his own "documentary in oils" of these colorful people. It was a unique experience for Roseman, 31, whose work in portraiture is documented by the National Portrait Gallery in Washington, D.C.

Roseman has also sketched some of the most significant musical and theatrical events of recent years in the U.S.; for several months he lived and travelled with the Ringling and Barnum & Bailey Circus, sketching and painting aspects of the personal lives of circus people.

Below: Myrdene Anderson (left) and Ronald Davis, artist Stanley Roseman's business manager, carry freshly painted canvas across river on which rowboat had been used only the day before. Painting of Bier Án'te, held by Davis, is reproduced at left. (Detail).

Lái'la and Kris'tien, in nativity-like scene, with their newborn. The style of crib is traditional.



His work of the theatre has culminated as an international traveling exhibition, "The Performing Arts in America," which opened February 14 at the Library and Museum of the Performing Arts at Lincoln Center in New York City.

The conditions under which Roseman had to paint in Kautokeino were immeasurably different from the studio facilities he was accustomed to in New York. At the time of his visit, the Kautokeino region was already coming under the blanket of winter, and for only two hours a day was the lighting at all adequate. Transportation, too, was a problem. On one occasion Roseman had to transport his large, stretched canvases by rowboat across a river. The following day, the canvases with their wet paint had to be carried in a gale over thin ice which had formed on the river.

The obstacles would have been far greater for Roseman, a total stranger in the far north, had he not met at the outset Myrdene Anderson, a Yale University graduate student who was just concluding five years' work among the Saami and whose article "On Coming and Going in Saamiland" appears here. She spoke the Saami language fluently and had developed a close rapport with many members of the Kautokeino community. Through Anderson, Roseman was able to locate appropriate, willing subjects for his canvas, and much of the reserve which Saami characteristically have towards outsiders was overcome. —Ed.

(Con't from p. 7)

vating potatoes and hay, have been the women; today, however, men are increasingly involved in the operation of heavy farm machinery or they are attracted to agricultural work by government subsidies.

Reindeer herders are also the beneficiaries of government subsidies. This aid, however, has the disadvantage of interfering with traditional modes of mobility. Women complain that their reindeer-herding activities are curtailed by their now having homes with modern conveniences (built with the aid of government subsidy) and by a modern school system which ties them as well as their children down for 10 months of the year.

Reindeer migration

A reindeer herd, its herders, and its other, nonherding owners are together known as a *sii'da*, and a single herd may be owned by one family or by as many as twelve. The average number of productive reindeer per family is about 200 head, but this number and total herd size may vary greatly.

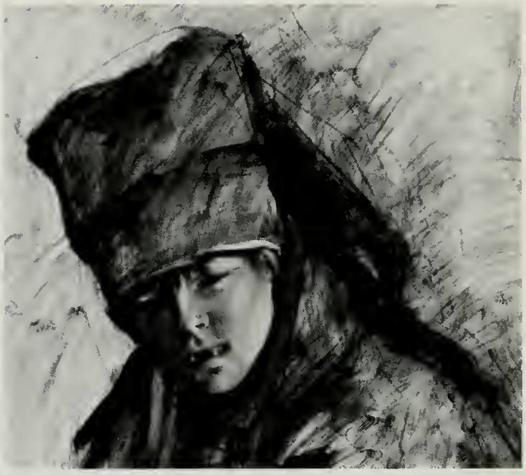
Accompanied by their herders, the reindeer graze on separate winter and summer range lands; the winter range lands are near Kautokeino, the residential base; the summer grazing lands are toward the west and north, along the seacoast. Each herd has its own spring and autumn migration routes, varying in length from 75 to 250 miles over the tundra. Herds with pasturage on river islands must swim across or be ferried over the turbulent channels. During the spring migration in particular, the herders are joined by family members. When there is snow cover, the transportation between herd and home is by reindeer-drawn sleigh or by snowmobile. When there is solid winter ice, the waterways serve as highways, but during the May ice breakup and the flooding that follows, travel of any sort may be risky or impossible.

Commuting to and from the herd is incessant, irregular, and rather uncoordinated. But during migration, numerous persons and nearly as many dogs move in the same direction as the reindeer, all seemingly driven by the same instinctive rhythm. Some members of the *sii'da* may make the migration journey by road, if for no other reason than that road vehicles may be required at the destination.

The family: comings and goings

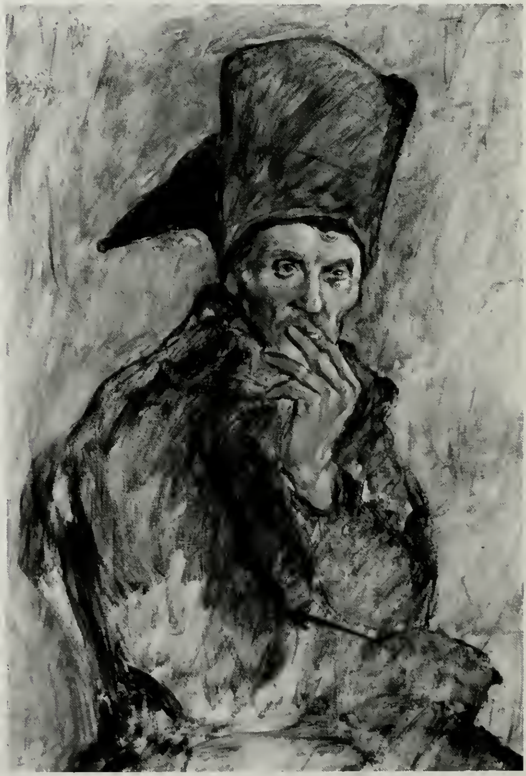
Many Kautokeino families have summer cabins on the seacoast, some stay in the homes of trading partners who are settled there, and still others spend much of the summer in traditional tents or sod huts. Members of families located near the one coastal road that has through traffic are all involved in selling homemade souvenirs to the summer tourists.

(Con't on p. 16)



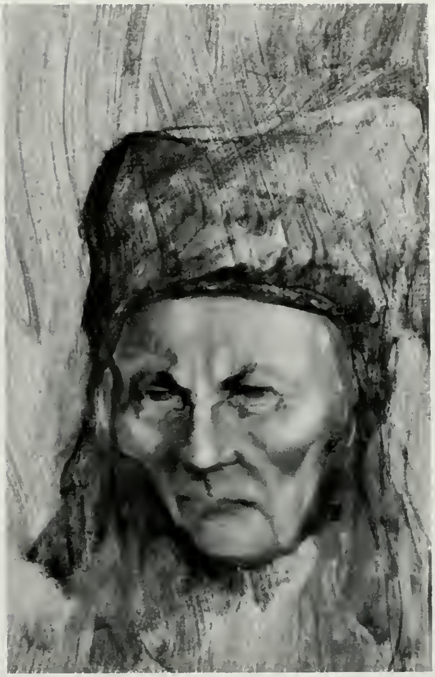
Án'te Niilas

Mát'te



Paintings of the Saami by Stanley Roseman

(details)



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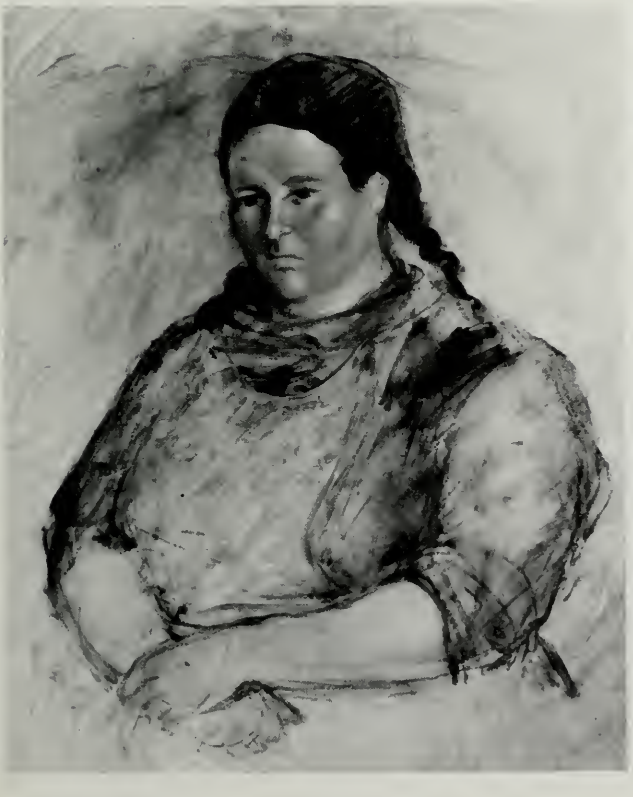
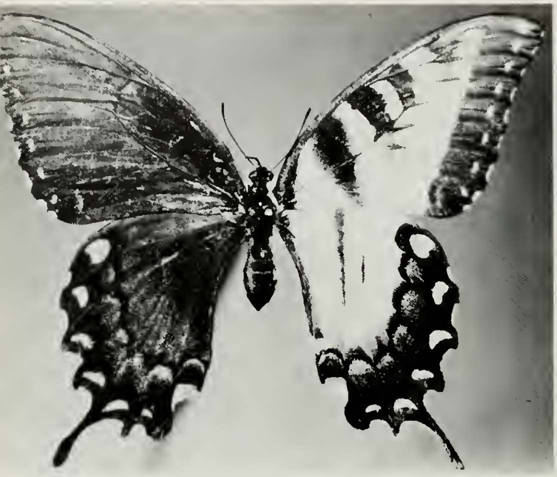
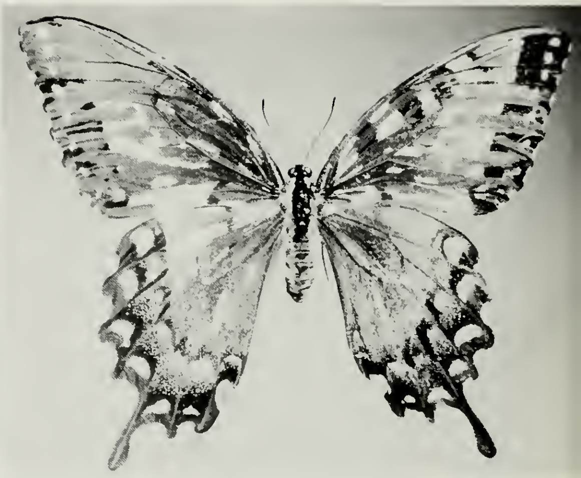






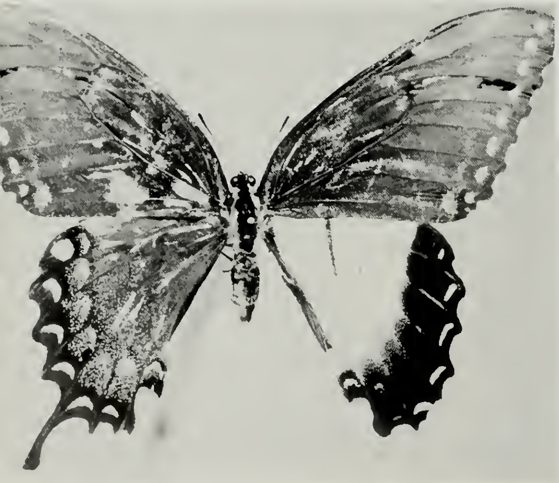
Tigers Without Their Stripes

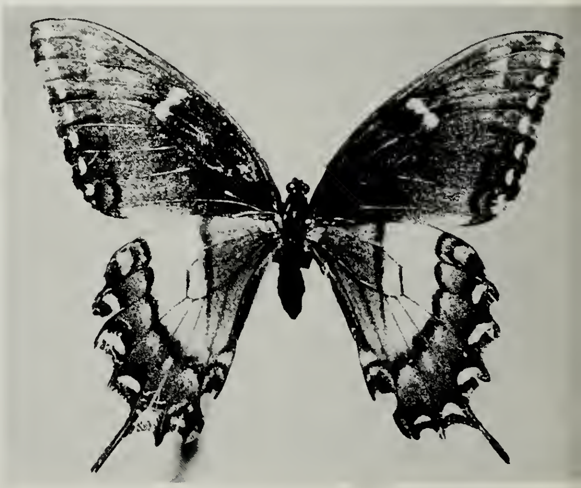
By David M. Walsten

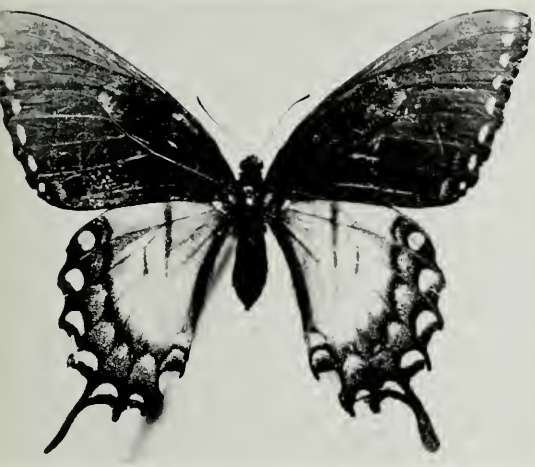
Thanks to nursery rhymes and TV commercials, Mother Nature is commonly seen as a lady of caprice, if not malice. The fact is that animals hideous or bizarre enough to instill such superstition are sometimes created as the result of genetic mutation or by injury to the organism early in its development.

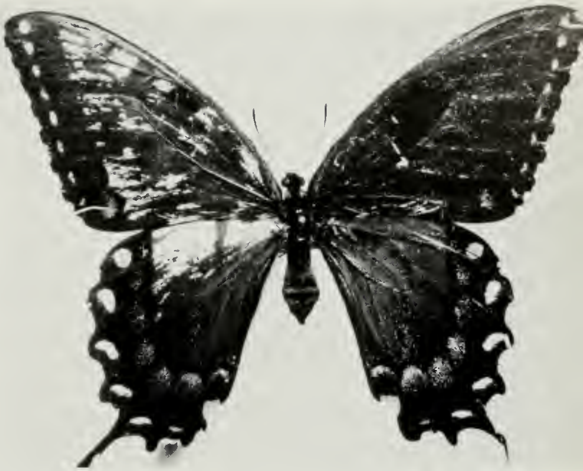
One such freak is the gynandromorph, which exhibits male as well as female characteristics. Accidents of this sort have been observed in a wide range of animal life, but are perhaps commonest among the insects. Those shown here are all specimens of the tiger swallowtail (*Papilio glaucus*), a common North American butterfly. In these butterflies the male-female difference occurs not just in the visible characteristics, such as wing pattern, but may also involve the internal organs of reproduction. In some gynandromorphs (also called gynanders) one side of the body may have a testis while the other side has an ovary.

The condition of gynandromorphism is ordained shortly after fertilization of the ovum, or egg, and such individuals always develop from a female egg; that is to say, one with two X chromosomes —a configuration known as XX. (Eggs destined to develop normally as males have an X chromosome and a Y chromosome—a configuration known as XY.) For reasons that are not fully understood, an accident of some sort may occur to one of the X chromosomes, resulting in an XO configuration. Such a cell gives rise to tissues with male characteristics. After a normal fertilized XX







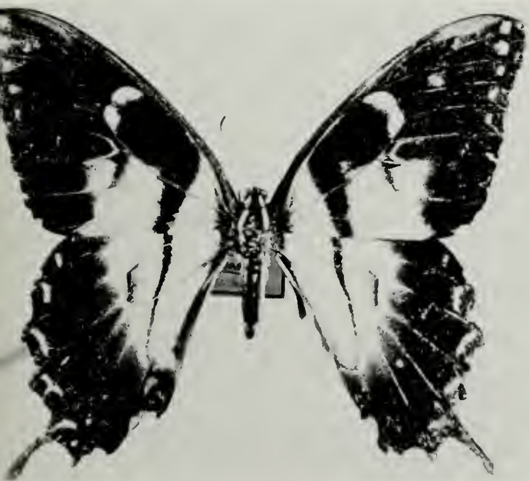


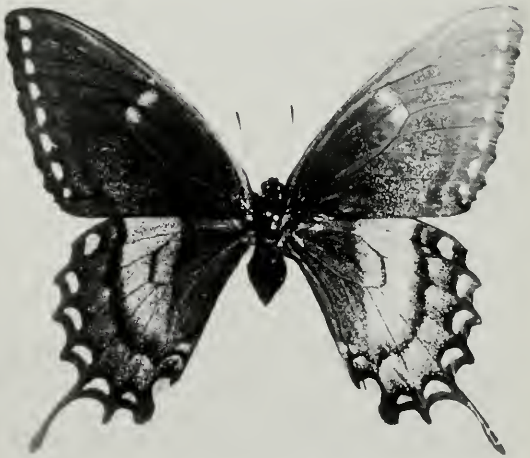
cell undergoes its first division, the two resultant cells both have an XX configuration. If an accident occurs to an X chromosome in one of these two cells, the configuration of that cell becomes XO or, in effect, male, while the unaffected cell remains female. As embryonic development continues, all the cells from the XX cell inherit and transmit female characters; those from the XO cell inherit and transmit male characters. The resulting mature insect, known as a *bipartite* gynandromorph, is exactly 50 percent male and 50 percent female.

If the accident occurs to one of the cells during the four-cell stage, the resulting individual is 25 percent male and 75 percent female. The later the accident occurs, the less obvious are the male characters. Butterflies in which the accident occurs at the eight-cell stage or subsequently, may show a splattered, or "mosaic," effect in the wing pattern. The specimens illustrated here show the effect of that accident occurring at various stages in the early development of the embryo.

In some insects the fertilized egg may sometimes be *binucleate* (*i.e.*, with two nuclei instead of the normal complement of one). If one of these two nuclei is female (XX), while the other is male (XY), the resulting individual will be gynandromorphic. This phenomenon has been observed particularly in adults of the commercial silkworm (*Bombyx mori*). The production of a greater number of gynandromorphs in certain wasp species has been artificially induced by subjecting the female insect to a temperature of 37°C.

The specimens shown here are from the Herman F. Strecker collection, acquired by Field Museum in 1908. Though not on public exhibit, the Strecker specimens have been much studied and photographed by geneticists and insect physiologists. ☐





Letters from Antarctica III

By Edward Olsen

Edward Olsen surveys bleak Antarctic vista.

The following report is the third from Edward Olsen, chairman of the Department of Geology and curator of mineralogy, who recently returned from searching for meteorites in Antarctica. His earlier reports appeared in the February and March Bulletins.

The summer season in Victoria Land: Antarctica has not been bad — not as bad as winter in Chicago, which was the worst winter in 104 years. In camp up on the Dewitt Nunatak, which pokes up through the Antarctic polar ice cap on the flank of the Trans-Antarctic Mountains, the only really uncomfortable weather was the long wind storms mixed with wind-driven grains of ice. Temperatures never got below 0°F and were generally 5° to 10° above zero. Except for a white-out condition one morning, the sun showed itself brightly 24 hours a day, adding considerable cheer to a scene of barren, plant-less, animal-less rock surrounded by rolling plains of hard blue ice.

We thought this would be a good place to search for meteorites, in an attempt to locate specimens on a scale similar to that of the Japanese. Their field parties had explored the Antarctic ice cap near the Yamato Mountains, which lie almost 2,000 miles away on the other side of Antarctica. There, the Japanese had recovered 992 specimens, which they believe represent fragments from about 320 separate meteorite falls.

In our former camp, some miles to the south of the present one, we did recover two meteorites; however, the Dewitt Nunatak region turned out to be a dud. Days of traversing on crampons over the ice fields in fierce winds

Until 1969, only 1,900 meteorites were known. These represented all that mankind had collected. Most of these were collected in the last 200 years, and a large portion are now in the Field Museum collection, one of the world's four largest.

The Japanese, in accidentally encountering almost a thousand more specimens in Antarctica, added a large percentage to the world supply of these extraterrestrial objects (although it isn't clear at the present time how many distinctly different meteorite falls all these fragmental specimens represent; it is probably close to 100, give or take a little). The expedition this past winter to Antarctica, recovering 11 more, adds a significant number to the world total. It should be pointed out that all *meteorite finds in the past, everywhere in the world, have resulted from accidental discoveries. The past winter's expedition is the first time in history that men have set out to discover meteorites, and found them, in an area where they have never been observed, nor ever reported to have been seen falling. It's an exciting first.*

produced only windburn and aching legs. The landscape is so utterly barren that it begins to get to you after a time. My former field experience has always been in regions of spruce trees, birds, rabbits, foxes, lemmings, fish-filled lakes, and — the most prevalent life forms — mosquitoes and black flies. I began to yearn even for some insects. When, on occasion, the wind would die, the silence is absolutely complete. You become conscious that there is a constant low-level ringing in your own ears — and it's all you can hear.

Once, while trudging across the ice, two skuas sailed into view. (Skuas are sooty-gray carnivorous gulls with a taste for penguin eggs, fish, and an occasional stray baby penguin.) They were a welcome sight. I waved my arms and one of them flew to me and hovered overhead, eyeing me quizzically. Although skuas are not much loved by man, I felt a sincere friendliness toward this one.

Finally, it was decided to give up on the Dewitt area, and give up for the season with only two meteorites. Two are better than none at all, but still a disappointment. On an appointed day a U.S. Navy helicopter sailed into view in the late morning, looking like a huge orange dragonfly. It set down, we folded our tents, and packed our camp into it and took off (in a howling wind, as usual) back to McMurdo Station. It was only late January, but it seemed pointless to continue. Of the several potentially promising areas we had planned to examine, only one had yielded specimens, and only two at that.

After a few days in McMurdo, one of the helicopter pilots, Lt. Ken Kraper, sought us out and told us about an extensive region of blue ice he had seen from the air adjacent to another nunatak, Allan Nunatak, 35 miles north of Dewitt. Our set of air photos did not cover this region so we wouldn't have known it was there if we hadn't been told. It lies 130 miles northwest of McMurdo and is near the limit of helicopter range.

The next day we gathered minimal equipment together and flew out. It was decided to make a preliminary survey by helicopter. We flew a search pattern about 50 feet above the ice at 15 to 20 knots. Within five minutes a large black rock was sighted off the port side. We set down and were flabbergasted to find a large stone meteorite (that weighed out later at 20 kg — about 44 pounds). Everyone — pilot, copilot, and the three of us then searched the adjacent area on foot. Through binoculars I spotted a small dark rock about 500 feet away. It turned out to be a neat little 1.5 kg (3.3 pound) iron meteorite. No others were found in the vicinity so we took off again and continued our search pattern.

To make a long story short, in the course of an hour we found two more stone meteorites. We would have continued longer; however, heavy clouds were moving in from the east. We had to fly at almost 10,000 feet to get over them, and that height in a helicopter I found a little scarey.

It looked as if this area, Allan Nunatak, would be a good place to put in a camp; however, the season was drawing to an end, and the helicopter operation was soon to shut down. Bad weather could be expected, and field camps were being brought in rather than sent out. We managed to get the promise of another day of helicopter flying out there.

A few days later we went out again and continued the search pattern. Again, within five minutes we spotted the first one, which turned out to be a rare type of stone meteorite, called an achondrite. Continued search turned up three more within an hour. The search was getting exciting by this time. Then the Navy air crewman, Dennis Shatzel, spotted a number of boulders that might have been a moraine, but were too isolated out in the middle of the ice field. We set down, all hopped out of the helicopter, each person running to a different rock and shouting *he* had a meteorite. They were *all* meteorites, all 33 pieces! It became clear they were fragments of a single meteorite fall that broke on impact. The two largest pieces were huge, weighing around 250 pounds each. There was a third large piece at 130 pounds, three pieces in the 50-80 pound range, and 27 pieces that weighed a few pounds down to a few ounces. It turned out the whole mass weighed 900 pounds (407 kg), making it by far the largest meteorite ever recovered from Antarctica and among the five or six largest stone metoerites every recovered in the world!

Straining our backs, we managed to load all the pieces into the helicopter. We had enough weight to carry so we decided to end the search. We took off and headed eastward, across the mountains, to the Ross Sea, where we followed the coast to the place where the Ross Ice Shelf edge met the open, iceberg-filled water. There, in a jolly good mood, we set down on the ice, and hiked to the ice edge. There were groups of killer whales rolling and lunging around just in front of the ice. Some of them stood on their tails, turning their heads from side to side, to see what kinds of creatures we were. A couple of us hiked for half a mile to see a group of Adélie penguins that were standing around on the ice. It was amazing. They didn't move as we walked up to them, and they watched us with grave curiosity. They are very engaging little people. We also saw some seals lolling on the ice (Weddell seals and a pair of elephant seals farther off). We stayed away from them; they will bite. But more of concern is the fact that where they are there are probably holes or cracks in the ice, and we could stumble into one and suffer an icy bath.

In a thoroughly good mood we took off for McMurdo Station. Because many field parties were being brought in before bad weather could trap them out there, we had no more opportunities for field work on helicopter searches. The field season had ended with a bang. Altogether we had recovered eleven meteorites

(Con't on p. 20)

(Con't from p. 10)

Not all reindeer-raising families, however, move to the coast for the summer; and some families in the same *sii'da* may occupy as many as six wooden dwellings during the year rather than the customary two. Despite the plenitude of a family's seasonal dwellings spaced over the landscape, at any given time they may all be unoccupied, for much time is spent moving one's self as well as one's family, retainers, dogs, provisions, and equipment from one place to another.

Many activities, other than moving, are carried out away from the home sites, with the reindeer as the main focus of attention. The animals are seldom within a day's walk of any residence; in the winter, however, the herd may be only hours away by snowmobile—if the herd can be located and has not dispersed into smaller segments or joined a larger herd. During the summer, on the other hand, the herd may be days away from the herder's residence.

Each reindeer is individually owned; pride and the responsibility of ownership helps to explain why everyone—children included—enjoys involvement in the cycle of reindeer work. Many of the events can be truly exciting—outwitting and maneuvering dispersed animals, or driving a herd to massive roundup for the ear-marking of fawns, for herd-sorting, for migration, or finally for slaughtering. Major activities of this sort may occur a dozen times a year for each *sii'da*, but customarily one assists members of other *sii'das* in their roundups as well, hoping to locate one's stray reindeer there. Between epi-

Left, above: Saami girl leads reindeer caravan to next habitation. Boy's modern tricycle, in striking contrast with traditional sleigh, rides behind him.

Left, below: Saami couple share bit of humor. Note man's reindeer hide leggings.

Above: The reindeer roundup.

Below: Gas for the snowmobile and other motorized vehicles is as essential as lichen for the reindeer and must be cached at proper intervals for future use.

sodes of hectic, strenuous activity a great deal of time is spent just waiting, partly because of the difficulty in coordinating the activities of the dispersed persons and animals.

The usual slaughter season for reindeer is autumn and early winter; before and after this the animals are too thin for slaughter, but for certain kinds of hides a few reindeer are culled during the summer. Travel conditions and herd location are the factors which determine whether the slaughtering is done at a dwelling site, on the range, or at the slaughterhouse.

Most of the yearly slaughter is sold commercially or is locally bartered; the remainder is used by the family. Non-reindeer-owning friends assist at the earliest roundups and sample the season's first meat, eagerly awaited by everyone. For these occasions the basis of the grouping is the *sii'da* and its members' trading partners.

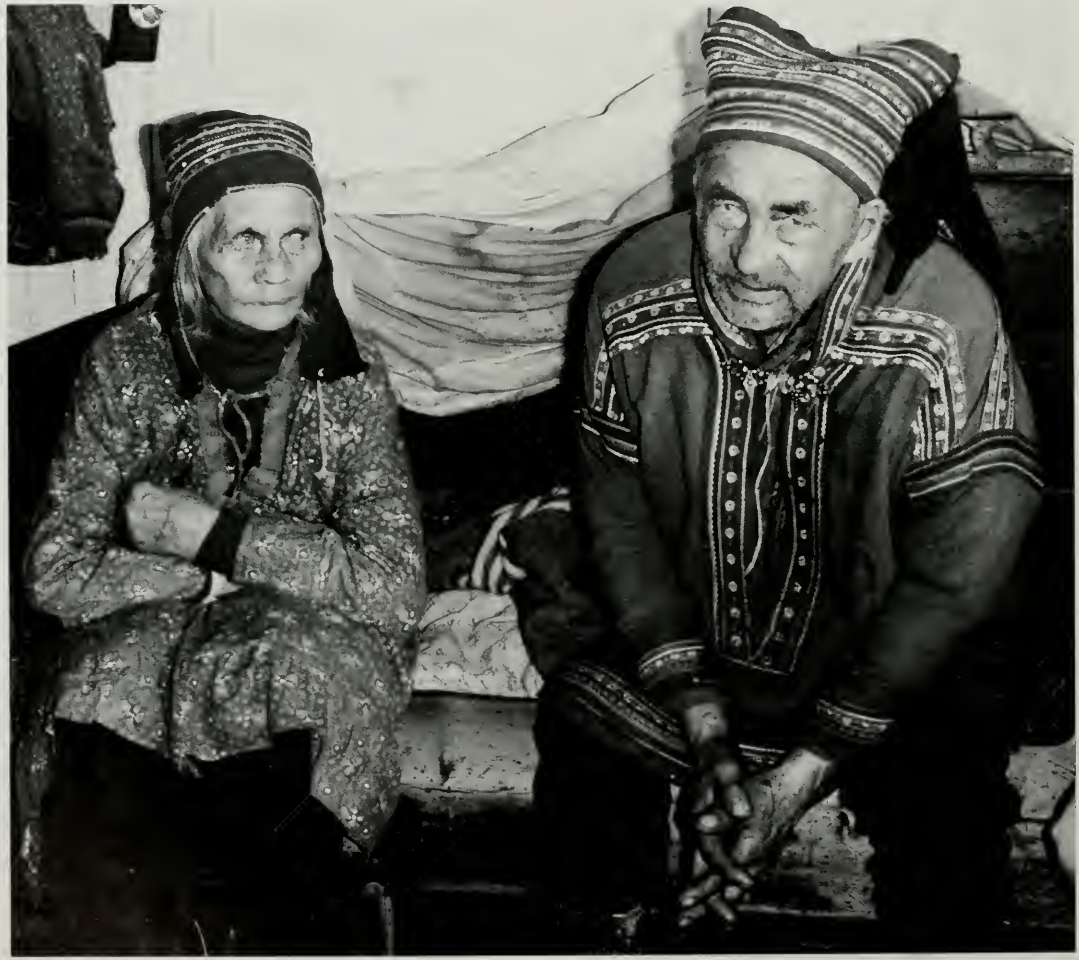
The scatter of individuals, the choreography

The unit of mobility among the reindeer-herding Saami is the individual rather than the family or the *sii'da*, for an entire family is seldom in the same place at the same time; and the members of a *sii'da* are even more scattered. Members of households as well as nonmembers come and go continually, arriving and leaving together or singly, and losing or acquiring traveling companions in the process. Even small children go out visiting on a

whim, have a snack at a neighbor's, take a nap, and move on to the next dwelling. The only pair that almost invariably travels together is a herder and his dog; but even the herding dog may make rounds without his master, checking out the meal scraps at a neighboring house or tent, sleeping it off, and moving on to the next habitation.

Even though the *sii'da* (the unit of herd cooperation) and the family (the unit of residence) are not basic units of mobility, the individual Saami is not a loner. He will have a companion or companions for many of the recurring activities of his life—constellations that separate and reunite endlessly across family, *sii'da*, and regional lines. Companionship will sometimes be sought out on the basis of convenience; at other times grouping appears to be fortuitous. Most of the time the companion is from outside the family, often from outside the *sii'da*, and sometimes even from outside the community. A companion from outside the Kautokeino community is likely to be a resident of the coastal area, and his relationship to the reindeer owner and his family is that of guest-host, host-guest, or trading partner. These coastal residents, who generally speak only Norwegian, may or may not

Biret and Bier Án'te, a married couple. Portrait of Biret is reproduced on p. 11 (top); portrait of Bier Án'te is reproduced on p. 8.



regard themselves or be regarded by others as Saami; nonetheless, the relationship between the two can be strong and enduring, and highly valued by both sides.

In late winter and spring, with the longer daylight hours, it is considered great sport to go ice-fishing for freshwater fish. Trout, char, and the lavaret whitefish (*Salmo* and *Salvelinus* species and *Coregonus lavaretus*, respectively) are virtually the only species considered delicacies. During the open-water season, Atlantic salmon (*Salmo salar*), is caught in the bays and up the larger rivers.

Except in summer, the hunting and snaring of game birds and animals are popular but casual pastimes done on the way to or from another activity. The most common game birds are the willow grouse (*Lagopus lagopus*) and ptarmigan (*L. scoticus*), a number of geese and duck species, the blue hare (*Lepus timidus*), and the red fox (*Vulpes vulpes*). None of the game species are ordinarily eaten or otherwise used by the inland Saami. Captured for sheer sport, the game is discarded on the spot or taken home, then thrown out after it has begun to spoil.

Early summer is the usual time to fell trees for firewood. Trees are no longer to be found near the main residential sites, and the only species of any size and occurring in any concentration is birch (*Betula pubescens*). Other deciduous species, which provide bark used in tanning hides, include several species of willow, of which the tree-size *Salix caprea* is the most valued, and gray alder (*Alnus incana*). These are harvested as needed throughout the year. Persons on a tree-cutting or firewood-hauling trip are likely to share equipment or vehicle transport with others on the trip, and more than likely they are from the same area.

Children forage on a number of herbaceous plants scattered in the wild, and they may make all-day treks in search of angelica (*Angelica archangelica*), the tall, hollow stalk of which is a favorite vegetable snack. They also chew on the sorrels *Rumex acetosa* and *Oxyria digyna* and eat the flowers of several heathers. Before the twentieth century, some of these species were extremely important in the diet of all Saami, but today very few persons can name wild edible plants other than angelica. The names used are usually Norwegian, because these plants are sought in the summer by the children in company with their coastal Norwegian-speaking playmates.

Late summer is berry-picking time. While numerous kinds of berries in the heath family grow in varying abundance both inland and along the coast, most of these are picked and eaten only by children. Exceptions are the cloudberry (*Rubus chaemaemorus*), growing on the tundra and ripening in August; and the cowberry (*Vaccinium vitis-idaea*), ripening in September, the richest patches at lower altitudes. These berries are often cash crops. Adults rarely go berry-picking alone. The usual berry-picking unit is never the family, but often groups of men and boys or women and girls from both the inland and coastal areas.

Boots, pails, and habitations

Tools, utensils, clothing, and furniture are also mobile, largely because they are not identified with any particular location and their users are numerous. They are generally left where last used, then used again by the next person to come along. Snowmobiles that have run out of fuel or snow cover may be left in the otherwise featureless landscape to be picked up at a later time—perhaps six months later. Even small frame structures may change location.

Sheds, outhouses, cabins, and houses of the Kautokeino region have all been constructed since World War II. Those built before the war were destroyed by the German army of occupation in anticipation of pursuit by the Soviets. All livestock was also destroyed then and nearly all inhabitants of the area evacuated. A few residents, especially those of Kautokeino, hid out in small groups during the war's final winter of 1944-45. When they emerged from hiding they lived in tents and later in barracks, before constructing more permanent houses. By 1950 many had government-subsidized homes, but these were so poorly put together that in recent years the Norwegian government has again had to subsidize the construction of dwellings. Meanwhile, any smaller buildings may have been moved from place to place much as one would move a tent.

The correlates of mobility

No assemblage of humans could withstand the atomistic, autonomous mobility that prevails among these Saami, yet remain an integrated society, were not their comings and goings necessary for their very survival. The mobility of the Saami is predictable only through the monitoring of information that is initiated or transmitted by each person as he moves about in his particular activity. With the accumulation of this constantly revised, updated information, each person has a remarkable knowledge of who is going where—how, when, and why. He is then able —indeed, obliged—to coordinate his own activities.

When they meet, the first order of business between traveling Saami is the exchange of such information. Instead of perfunctory 'hellos,' they ask one another: "Where are you coming from? Who was there? Did you see anyone along the way? Did you see any reindeer?" If one is not traveling he is asked: "Has anyone passed through recently? What did he say? Where was he headed? Have you heard any other news?" These dialogues, which might be small talk among any other people, are vital to the Saami's highly mobile way of life. □

(Con't from p. 15)

with a total weight of just over half a ton (460 kg)! Among them was the largest meteorite ever found in Antarctica. It was definitely a successful field season.

It's interesting to compare these finds with the Japanese finds on the blue ice field adjacent to the Yamato Mountains, 2,000 miles away. Their average meteorite fragment weighed only 100 grams. Our average was 5,000 grams (leaving out the huge 407 kg one). Their total weight recovery was about 100 kg; ours was 460 kg. So it was, that we found fewer meteorites but larger ones. This leads to the possible conclusion that their 992 fragments may represent far fewer than their estimate of 320 different falls. Problems of this kind can be solved when other regions of Antarctica are search and the number of meteorites per square mile determined. It seems likely that other countries with stations in Antarctica will attempt similar searches in regions near their stations. In fact, I was later interviewed, at McMurdo, by Australia's minister of science, a cabinet member, who was visiting the U.S. Antarctic operation. We talked for half an hour and I was flattered to watch him taking notes on what I said. It's clear that the Australians will include a meteorite search group in their future Antarctic operations from their own bases.

One thing is clear. Antarctica is a storehouse for meteorites, where they are well preserved in the ice, and concentrated by ice movements. Searches here have a high probability of yielding specimens. For any other part of the world such searches are very much "needle-in-the-haystack" operations. Because meteorites are the only tangible objects we have from far reaches of the solar system, searches for additional specimens are very desirable.

Looking back on the period of just over two months in Antarctica some things stand out. It is a remarkably awesome place, and just a bit frightening. I never got a feeling of love for the land there — I was fascinated, but felt no warmth towards it. Perhaps it was the lack of any living plants or creatures — the utter barrenness of the ice cap, a featureless plain whose monotony was relieved only by an occasional nunatak of bare rock poking up out of the ice. Also, I always had the feeling that I was walking on the back of an impassive giant. At any moment, I feared, she could change her mood and wipe me out like stepping on an ant. Antarctica is always clearly the master, and I was allowed to be there only by her deference.

In spite of this cold, frightening aspect, there was one recurring theme which satisfied the soul of the romantic. Each day I could walk into a small ravine in the ice, or a valley in a nunatak, or stand on a ridge of a hill, and say to myself, "Only two have seen this place before — God and I". There are few places on this earth anymore where it is like that. □

Weekend Geology Field Trips for Members: Starved Rock and the Baraboo Range

An overnight trip for Museum members to Starved Rock State Park, 80 miles southwest of Chicago, will take place on Saturday and Sunday, June 4 and 5, under the leadership of two Field Museum geologists: Gordon Baird, assistant curator of fossil invertebrates, and Matthew Nitecki, curator of fossil invertebrates.

The flat, horizontal rocks of central Illinois are interrupted by the spectacular upfolding of older rocks; eons ago these formations were cut into picturesque glens and canyons. Field trip participants will explore and study these formations and consider the influence they have had on the region's economy.

Field Museum Members will again have an opportunity on Saturday and Sunday, June 11 and 12, to explore Wisconsin's Baraboo Range, a field trip which was so successful last year. The trip leader will be Edward Olsen, chairman of the Department of Geology. The Baraboo Range is of special interest as a *monadnock*—what is left of an ancient mountain range and now stands above the younger rocks and sediments. The range consists of quartzite—more than one billion years old—which, although compressed into vertical folds, retains the original sedimentary structures. The mountains were further modified by glaciers, forming beautiful Devil's Lake and picturesque glens, and changing the course of rivers. Our "lecture tour" will take us through the range and along the shores and hinterland of Devil's Lake.

The Starved Rock and Baraboo Range groups will leave the Museum at 8:00 a.m. on Saturday mornings (June 4 and 11, respectively) and return on Sunday evenings between 6:00 and 7:00 p.m. The cost of each educational tour is $65 per person, which includes all expenses of transportation on a deluxe charter bus and overnight first class accommodations (Price is based on double occupancy; single accommodations extra). The fee also includes all meals and gratuities, except personal extras such as alcoholic beverages and special food service.

Hiking clothes and boots or sturdy shoes are strongly recommended for the scheduled hikes. The trip is not suitable for children, but young people interested in natural history are welcome. Each group is limited so get your reservation in early!

For further details write or call Dorothy Roder, Field Museum 922-9410, ext. 219.

Field Museum Field Trip

I wish ________ reservations for field trip to:
(how many)

☐ Starved Rock (June 4-5)

☐ Baraboo Range (June 11-12)

Name ____________________

Street ____________________

City ____________ State ________ Zip ________

Phone ____________

Amount enclosed ($65 per person) ____________
(Make check payable to Field Museum)

Return this coupon or facsimile today!

Workmen install huge glass panes inside north portico of the Museum. The strikingly beautiful, new "front door" opened in mid-April.

D. Walsten

Volunteers Honored

David Weiss (rt.), who volunteered more than 885 hours in 1976 to the Department of Anthropology, receives commendation from Field Museum President E. Leland Webber.

Field Museum's Volunteers have again outdone themselves! Just in terms of hours of service to the Museum in 1976 they surpassed their 1975 record performance by more than 13 percent, with a total of 32,957 hours given by 208 volunteers. Their performance during this period is even more remarkable when we consider the disruptions caused by the Museum's vast renovation program.

Working with 44 staff members in anthropology, geology, publications, botany, zoology, education, exhibition, and the library, the volunteers contributed expertise in photography, cataloguing, searching and researching, writing, editing, teaching, organizing (people as well as materials), and even morale-building. They also contributed skills as basic, yet as essential, as cleaning and typing, and in areas as specialized as inventing!

Every volunteer is a specialist in his own right, and the contribution of each is unique; but what the 208 do have in common is their spirit of unselfish dedication and loyalty to Field Museum. For this, the Museum shall be forever indebted. On February 16, as a token expression of their appreciation, the Museum staff honored these very special people at a dinner-reception in Stanley Field Hall.

The volunteer program at Field Museum is aimed at providing a vehicle for personal growth and continuing education. Anyone age 18 or over who has a serious interest in the natural world and is able to give at least one day each week is invited to participate in the program. Persons interested should call (922-9410, ext. 247) or write Carolyn Blackmon, Department of Education.

Special recognition is given the following volunteers:

John O'Brien (907 hours), *Education;* assisted in preparation of Harris Extension materials and resources materials.

David Weiss (885.5 hours), *Anthropology*; curatorial assistance, Oriental collections.

Sol Gurewitz (838 hours), *Anthropology*; photographing artifacts, recording data.

David Blanchard (838 hours), *Anthropology*; research and publication of archival photographic material.

LeMoyne Mueller (714.5 hours), *Zoology*; curatorial assistance, invertebrates.

Jim Swartchild (708.5 hours), *Anthropology*; photography, anthropological collections and public relations.

Paul Gritis (682.5 hours), *Zoology*; curatorial assistance, primate monograph.

Alice Schneider (673 hours), *Anthropology*; Chinese rubbings monograph.

Louva Calhoun (621.5 hours), *Anthropology*; illustrating lithic tools for publication.

500 hours or more:

Peter Gayford, Anthropology; cataloguing, Chinese rubbings research, Egyptian antiquities.

Ralph Hogan, *Anthropology*; Chinese translation and research.

400 hours or more:

Betty Lou Girardi, *Zoology*; research and curatorial assistance in invertebrates.

Fleur Hales, *Photography Div.*, photographing specimens and Museum activities.

Margaret Martling, *Botany*; cataloguing.

M. E. Rada, *Anthropology*; curatorial assistance, invention of measuring devices for research.

Maija Sedzielarz, *Anthropology*; research Northwest Coast collections.

Harold Voris, *Library*, cataloguing.

300 hours or more:

Zoe Emas, *Anthropology*; clerical assistance, Asian collections.

James Burd, *Anthropology*; curatorial assistance, Asian collections.

Frederica Irvin, *Anthropology*; cataloguing.

Llois Stein, *Anthropology*; cataloguing.

Anne Leonard, *Anthropology*; research, tapacloth project.

Malcolm Jones, *Education*; teacher, resource facilitator.

Carole Schumacher, *Geology*; cataloguing.

Lorain Stephens, *Zoology*; compiling bird gazeteer.

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May and June at Field Museum

(May 15 through June 15)

Special Exhibits

Treasures of Tutankhamun—through August 15. This exhibit, on loan from the Egyptian government, features a dazzling display of 55 of the most beautiful and best-preserved objects from the tomb of the pharaoh who lived 3,300 years ago. Among these are the startling golden effigy of Tutankhamun, the graceful gilt statuette of the goddess Selket, a gilded figure of the young pharaoh harpooning, and a small gold shrine of exquisite craftsmanship. The exhibit also includes superb examples of Tutankhamun's funerary jewelry, furniture, writing materials, musical instruments, games, and decorative objects of alabaster and ivory. (Cosponsored by the University of Chicago's Oriental Institute.) Monday through Wednesday, 9 a.m. to 6 p.m.; Thursday through Sunday, 9 a.m. to 9 p.m.

The Magic of Egyptian Art—through August 15. A supplementary exhibit at the Oriental Institute, 1155 East 58th Street, runs concurrently with the Tutankhamun exhibit at Field Museum. It features artifacts from the Oriental Institute's permanent collection, including objects used in the actual embalming of Tutankhamun and at his funerary banquet. Tuesday through Saturday, 10 a.m. to 4 p.m.; Sunday, 12 a.m. to 4 p.m.

New Programs

Audio Information System. The museum's newly installed audio system, Uniguide, enables visitors of all ages to visit up to 50 selected exhibits in any sequence they choose. Complete with background music, sound effects, and factual information supplied by the museum's scientific and education staff, this system provides an entertaining as well as educational experience. Specially designed audio receivers and maps are available for a nominal fee at the entrance to the Museum Shop, main floor.

Summer Journey for Children: Spelunking—June 1 through August 31. Self-guided tour for children (with or without parents) leads them to exhibits that exemplify the geology and biology of caves. The *Journey* poses numerous questions about caves. Among them are: In what type of rock are caves found? How do caves differ from other environments? What animals live in caves? *Journey* sheets are available at the information booth, main floor.

Continuing Exhibits

The Place for Wonder. This gallery provides a place to feel, try on, handle, sort, and compare natural history artifacts and specimens. The possibilities are endless—and so are the chances to ask questions and get answers. (Trained volunteers are on hand to help and guide in exploration.) Opens promptly: weekdays, 1 p.m. and 2 p.m.; weekends, 10 a.m., 11 a.m., 1 p.m., 2 p.m., and 3 p.m. Located near the new cafeteria, ground floor.

Man in His Environment. This exhibit takes a global view of some of the most serious environmental problems confronting all mankind and asks visitors to involve themselves in these problems —and the need for solution. Hall 18, main floor.

Continuing Programs

Spring Journey for Children: "How to Read a Bird"—through May 31. A highly acclaimed self-guided tour for children (with or without parents) directs them through the museum's bird halls. The *Journey* shows how to observe different characteristics of birds, and reveals the reasons for these differences. *Journey* sheets are available at the information booth, main floor.

Weekend Discovery Programs. Saturdays and Sundays, 10 a.m. to 3 p.m.: take tours, follow demonstrations, participate in museum-related activities.

The Ancient Art of Weaving. Members of the North Shore Weavers' Guild demonstrate weaving and spinning every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

Museum Hours Now through August 15

The Museum Opens daily at 9 a.m., closes at 6 p.m. Monday through Wednesday and 9 p.m. Thursday through Sunday. On Fridays, year-round, the museum is open to 9 p.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday. Obtain pass at reception desk, main floor.

Museum Telephone: 922-9410.

June
1977

Field Museum of Natural History Bulletin

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of Natural History
Bulletin

June, 1977
Vol. 48 No. 6

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Field Museum of Natural History

Founded 1893

President and Director: **E. Leland Webber**

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CONTENTS

3 **Field Briefs**

4 **Prehistoric Agriculture in the Midwest**
by Thomas J. Riley and Glen Freimuth

9 **Our Environment**

10 **Endangered and Threatened Species of the United States and Puerto Rico**

12 **Life in Ancient Peru**
by Robert A. Feldman, research assistant in anthropology

18 **Looking for 'Unimproved' Land**
by Mike Madany

back cover **June and July at Field Museum**
Calendar of coming events

The editor gratefully acknowledges the editorial assistance of Hermann C. Bowersox, a Field Museum volunteer, in the preparation of this issue.

COVER

Spring at Wolf Road Prairie with fragile purple prairie phlox *(Phlox pilosa),* golden hoary puccoon *(Lithospermum canescens),* brilliant scarlet Indian paintbrush *(Castilleja coccinea),* and more than two dozen other native wildflowers provides a kaleidoscope of color in early June. This spring show has been performed without interruption for the past few thousand years. Photo by John Kolar.

In the 1920s, this 80-acre tract of vanishing prairie, located at 31st Street and Wolf Road in Westchester, Ill. (15 miles west of Chicago's Loop), was threatened with development (see Feb. 1975 *Bulletin*). Today the Wolf Road Prairie is again in danger of being developed into a residential area.

This past year, an organized request was made to the Village of Westchester for a special assessment to install utilities which would pave the way to the construction of homes in the prairie area. Though the special assessment is but a first step in a lengthy and expensive route to the urbanization of the prairie, if approved, it could well mean that in a few years the more than 140 species of native plants will be replaced by bluegrass, crabgrass, dandelions, and plantain.

Save the Prairie Society, a group of people committed to preserving this piece of Illinois heritage, is currently purchasing parcels of the prairie with funds donated by the Joyce Foundation, La Grange Park Garden Club, Lyons Township High School Conservation Club, and more than 100 private citizens. Society members are also attending Westchester village board meetings to keep abreast of the special assessment activities. These efforts are being made to ensure that future generations may see firsthand the spring blooming of Wolf Road Prairie. For more on prairies and other natural areas of Illinois see "Looking for 'Unimproved' Land: The Illinois Natural Areas Inventory," p. 18.

Field Briefs

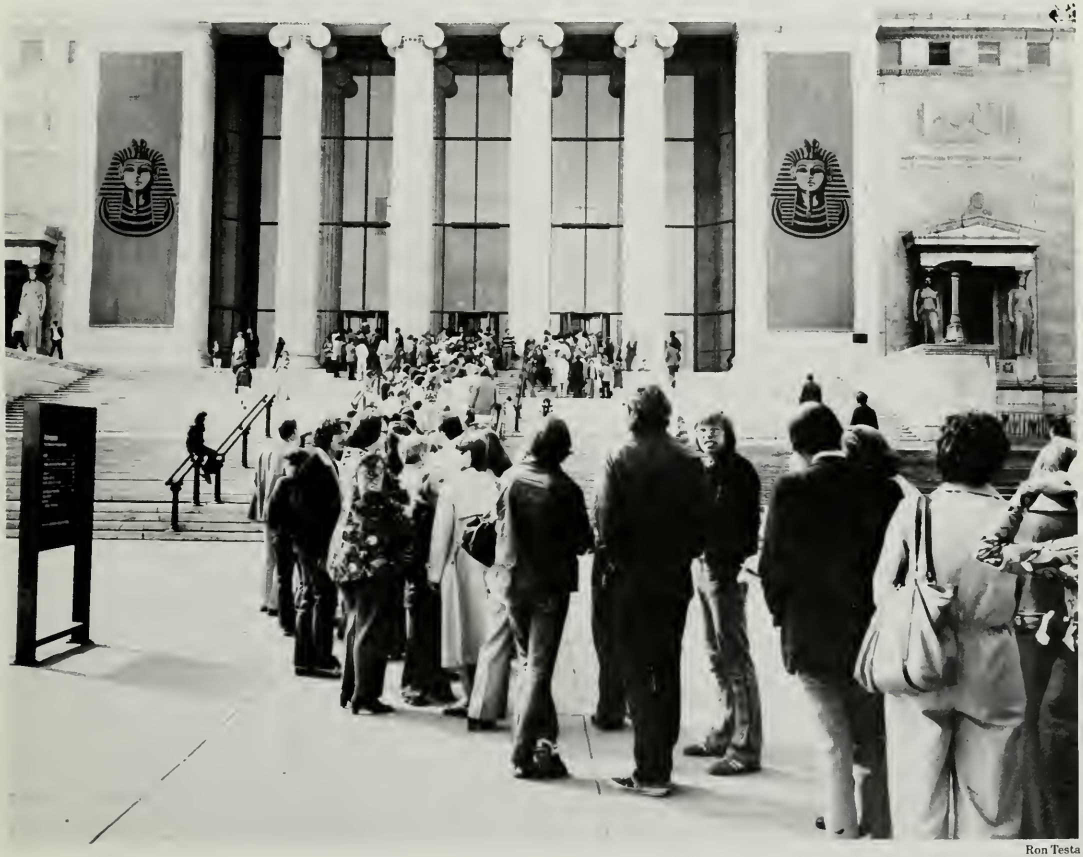
The "Tut" Exhibit: A Major Historic Event

Friday, April 15, 1977, was one of the most memorable dates in the history of Field Museum, as it marked the opening of the four-month "Treasures of Tutankhamun" exhibition. Fresh from a four-month stay at Washington D.C.'s National Gallery of Art, "Tut" opened at Field Museum with all the fanfare appropriate for the arrival of a distinguished head of state. As shown in the photo below, crowds waited patiently in line in front of the Museum on that historic morning before the doors opened.

But queueing up is essentially a thing of the past. Once the Museum has opened its doors for the day, those wishing to view the Tutankhamun exhibit are issued a number at a special desk, "Tut Central," in the center of Stanley Field Hall. Television screens, located at convenient points in the Museum, indicate which numbers are then being admitted to the exhibit, so that if there is a waiting period, visitors may meanwhile view other exhibits, see a museum film, visit the dining or gift shop areas, or enjoy other Museum facilities. Members do not have to wait, but may go to the exhibit immediately.

Costs for organizing the "Treasures of Tutankhamun" exhibit were met in part by a grant from the National Endowment for the Humanities, matching grants from Exxon Corporation and the Robert Wood Johnson Jr. Charitable Trust. All costs of installation of the exhibit in Chicago were paid for by the participating institutions: Field Museum and the University of Chicago.

Questions about matters pertinent to the Tutankhamun exhibit may be answered by dialing "Tut Central": 922-5910.

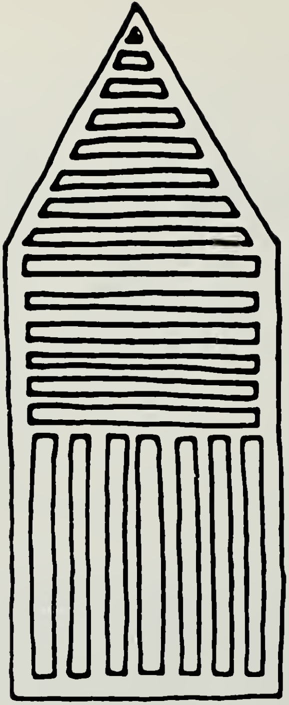


Ron Testa

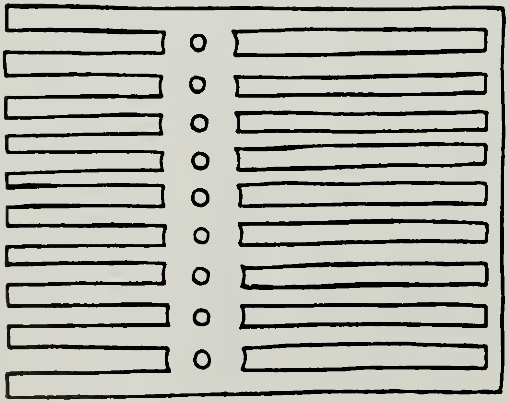
Prehistoric Agriculture in the Upper Midwest

Long before the coming of European settlers, the Indians of the upper Midwest employed highly sophisticated techniques of crop production

By Thomas J. Riley and Glen Freimuth



The designs on this and the facing page are types of geometric garden beds made by prehistoric peoples of the upper Midwest. (From W. B. Hinsdale, Atlas of Michigan Archaeology, *Ann Arbor, 1931.)*



Widely scattered across the landscape of Wisconsin and southern Michigan are a series of archaeological phenomena that have puzzled ethnologists and archaeologists alike for more than a century. These are the famous ridge-and-furrow agricultural fields of the upper Midwest. Even now, archaeologists do not know who constructed them, whether they are early or late among the prehistoric agricultural Indians of the eastern United States, or why the garden beds were built in rather geometrical patterns that almost presage the practices of American farmers engaged in present-day tractor-and-plow farming.

During the historic period, Indians in the eastern United States and Canada universally made garden plots of small "corn hills," very much like those recorded by the Pilgrims in the 1620s in eastern Massachusetts. A number of historic and protohistoric agricultural plots showing cornhills have survived: in the Connecticut River valley in Massachusetts, in New York, Ontario, Wisconsin, and as far west as Iowa along the Rock River. These plots can all be ascribed to various tribes of Native

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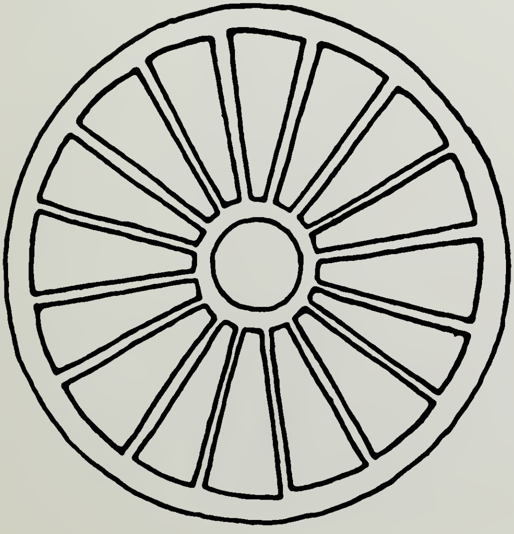
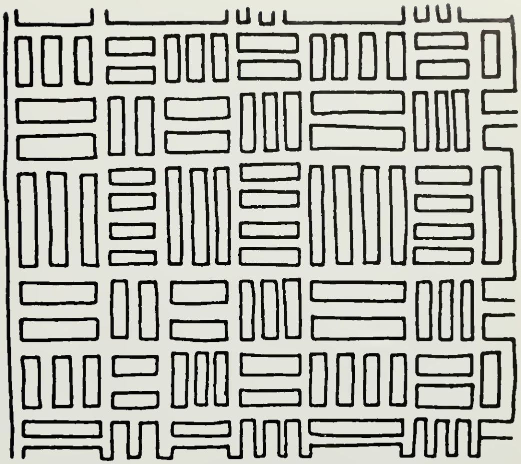
Americans from the seventeenth to the end of the nineteenth century, and it is fair to say that the Indian groups east of the Mississippi River almost universally used this agricultural technique during historic times.

In contrast to these cornhill agricultural plots, the prehistoric garden beds of Wisconsin and Michigan are not mounds, but linear trench and earthwork features, constructed in any one of four regularly duplicated geometric patterns. Some of the plots consist of parallel lines of ridges and furrows, while others are short sets of three or four ridges about 18 feet long with furrows between them. These sets are perpendicular to one another to make a checkerboard effect. One pattern has a central mound with ridges and furrows radiating like spokes on a wheel. Another pattern, mentioned by early reporters, is five-sided and surrounded by an outer ditch. The garden beds range in area from less than an acre to more than 120 acres, with the furrows between beds varying from 8 to 24 inches in depth.

These basic features were obviously important in the agriculture of some prehistoric occupants of the Great Lakes area. Who were these farmers and why did they spend so much time building these geometric plots that have been described by one archaeologist as being quite like "formal gardens"?

The question of who built them has been one of the major mysteries behind the garden beds for 140 years. Henry Schoolcraft (1793-1864), one of the fathers of American ethnology, was the first scientifically oriented traveller to report their presence in Michigan. He suggested that the garden beds in Michigan were being built around or before A.D. 1500. His observations were based on a primitive use of dendrochronology—he counted the rings of recently cut oaks that had grown over one of the Michigan garden plots.

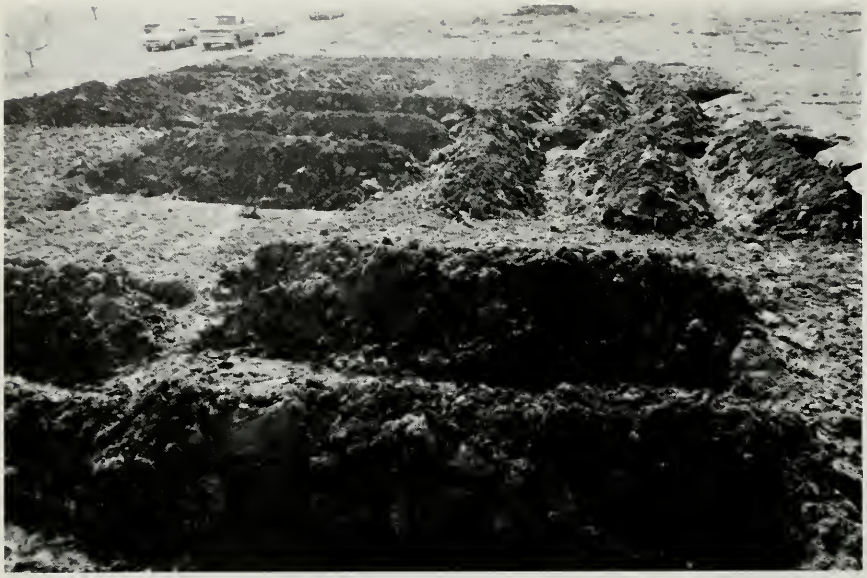




Increase Lapham (1811-1875), a surveyor who conducted a systematic mapping of the prehistoric earthworks of Wisconsin around 1850, recorded the presence of garden beds in several localities of the southern and central parts of that state. He was also the first researcher to try to put the garden beds into a cultural perspective. Lapham observed that a set of garden beds had been constructed over a set of effigy mounds about five miles north of Milwaukee, and that they were quite different from historic Menominee and Winnebago cornhill gardens. From his observations, he concluded that there were four phases to Indian cultures in Wisconsin prehistory: (1) the moundbuilders who constructed the effigy mounds and other edifices in the state, (2) the garden bed cultivators who came after the moundbuilders, (3) the prehistoric corn hill farmers, and (4) the historic Indians who were also cornhill agriculturalists.

Lapham's conclusions were cautiously made, and we know now that the prehistory of Wisconsin, and indeed that of the upper Midwest in general is much more complex and of much longer duration than Lapham or other early investigators thought. Lapham's work is important, however, when considered in conjunction with Schoolcraft's as we attempt to bracket the construction of the garden beds between A.D. 500 (the middle part of effigy mounds culture), and A.D. 1500-1600 (Schoolcraft's tree ring observations).

This has still left archaeologists with plenty of room



Experimental garden bed at the University of Illinois

for speculation on the builders of these agricultural plots, and there have been numerous attempts to attach the garden beds to one or another culture of the upper Midwest. Paul Radin, an ethnologist writing in 1911, suggested that the garden bed builders were ancestors of the present-day Winnebago of Wisconsin. George Irving Quimby, an archaeologist (and Field Museum staff member 1942-65), was impressed by the geometric arrangements of the plots and suggested that they were constructed at the end of what archaeologists call the Middle Woodland period—around A.D. 500 to 600. Middle Woodland was characterized in parts of Michigan and Wisconsin by the construction of linear earthworks that expressed the same fascination with geometric form as the garden beds, and Quimby used this fact alone to justify his conclusions. More recently, G. Richard Peske conducted excavations at two Wisconsin sites which contained remnants of ridge-row garden beds. Based upon his excavations, Peske concluded that the garden beds were the result of row heaping done with hoes made of bison scapulas and possibly with clam shells and were constructed sometime between A.D. 1000 and 1300.

Radin's, Quimby's, and Peske's ideas have not been universally accepted by other investigators, and the garden beds have variously been attributed to the prehistoric ancestors of the Mascouten, the Sac-and-Fox, Potawotamie, and other known tribes of the upper Midwest. But aside from the fact that the garden beds were probably constructed between A.D. 500 and 1600, we know little about the particular cultures that produced them.

A second major question about the garden bed features is why they were built. What function did this form of technology serve in the agriculture of prehistoric Indian societies? To answer this, archaeologists from the University of Illinois, Urbana, recently decided to look at environmental conditions peculiar to Wisconsin and Michigan that might be related to the garden bed phenomena of those two states. The research was prompted by the suggestion that the garden beds were adaptations to environmental conditions not found elsewhere in the Midwest.

Richard Yarnell, a University of Michigan researcher, had noted in 1964 that almost all the prehistoric archaeological sites in Wisconsin and Michigan that had yielded the remains of cultivated plants were south of the line that represented at least 130 frost-free days during the summer growing season. He concluded, on this and other evidence, that the most important environmental factor related to prehistoric Indian agricultural in the upper Midwest was the duration of the frost-free season.

To see whether the garden beds were related to frost-free zones, we plotted the known garden beds against U.S. Department of Agriculture maps of the frost-free seasons of the Great Lakes Area. A positive correlation was noted, with known garden beds falling on either side of the present 150 frost-free-day zone. In fact, the 150 frost-free-day line almost perfectly bisects the distribution of reported garden beds in Michigan and southern Wisconsin, while the modern 120 frost-free day line bisects a set of central Wisconsin beds.

Starting with this information, we explored the possibility that the mounding and furrowing in the garden beds might be adaptations to abnormally early frost conditions. Adding to our evidence, we found that early immigrants to central and southern Wisconsin had experimented with maize agriculture in the 19th century, but had abandoned this crop because of abnormally early frosts. For some time, 19th-century farmers thought that it was impossible to get adequate yields of corn because of the short growing season in the state, but as forests were cleared and expanses of open ground became larger, it was discovered that the problems of early frosts disappeared. Apparently, early frosts occurred only in what climatologists call "coldspots," where forest cover impeded the circulation of air and colder, chilling air sank to the ground, forming a frost trap. This condition is often intensified on clear, windless nights by the rapid radiation of heat from the ground. The result is what farmers sometimes call a "moon frost" because of the clear conditions that precipitate it. Moon frosts, or radiation frosts as they are known to climatologists, can occur in protected pockets of Wisconsin and Michigan as early as August 15, and can destroy a nearly mature corn field in the course of a night.

In spite of the technological weaponry of modern agriculture, frosts continue to be a problem for farmers in many areas. In cranberry bogs, frost is combatted by flooding the bogs on chill windless nights. The plants are entirely submerged, and protected from the cold layer of air near the ground by heat radiating from the ground into the water. However, flooding can only be used on crops such as cranberries that can tolerate submergence in water. Early in the twentieth century, the production of fog or smog from smudge pots was used to alleviate frosts in Germany and in the American South. The fog, which lay along the ground like an artificial cloud layer, served to reflect heat back into the soil and thus keep the lower layers of air from producing frost conditions. Today, a variety of methods, including fires and large fans, are used to produce artificial wind to keep frost conditions from occurring in California and Florida.

All these are modern methods of combating radiation frosts, and prehistoric agriculturalists did not have the technological expertise to protect their crops through the use of electrical fans, smudge pots, and the like. How, then, do subsistence farmers in various parts of the world today protect their crops from abnormally early frosts?

The Enga of the New Guinea highlands live in an area that is marginal for sweet potato agriculture, because of the frequent early frosts that can potentially destroy their major food source. Eric Weddell, a McGill University researcher who has studied Enga agriculture, notes that the Enga protect their sweet potato tubers by planting them in large, often oblong, mounds. The mounds are about two feet high, thus raising the planting surface above the natural ground. On clear, windless nights when frosts could be expected to form, cold air sinks to the low ground below the mounds, keeping the summits frost-free. This simple maneuver of mounding protects Enga sweet potato crops from occasional, but disastrous, killing frosts during the growing season.

Weddell's description of the mounding methods of

Monitoring temperature and humidity in the experimental garden beds the Enga, and their function as a frost-drainage device, suggested to us that perhaps early agriculturalists in Wisconsin and Michigan built their ridge-and-furrow garden plots for the same reason. Working on this assumption, we constructed a test to simulate the ridge-row beds and test their frost drainage capabilities.

In the spring of 1976, we constructed an experimental garden bed at the Ornamental Horticulture Laboratory of the University of Illinois. The two most common types of garden plots, parallel ridges and the checkerboard design, were simulated in our test plot, which measured 107 feet long east-west and 78 feet wide north-south. Ridges and furrows were built with one-foot, two-foot, and three-foot differences between the tops of ridges and the bottoms of furrows.

We monitored air temperature, soil temperature, and humidity of the air within two and one-half inches of the ground during the autumn of 1976 to determine whether the ridge-and-furrow field systems could have served as frost-combating devices. Unfortunately, there were few nights in which conditions for radiation frost were present in the fall of 1976, but we did get several frosty nights in mid-October when localized frost occurred.

On the mornings of October 16 and 17, we recorded temperatures at our simulated garden beds in which the furrows of the beds with a two-foot differential had gotten down to temperatures of 31° and 30° F., while the ridgetops stayed at 34° F. and 33° F. These nights were either clear or partly cloudy and the wind direction was from the north and west with a velocity of less than five miles per hour. The measurements, which were on rows aligned east-west in the checkerboard pattern, demonstrated that the ancient fields could indeed serve as frost-combating devices. The winds from the north and west on these evenings probably abated during the periods when the minimum low temperatures were obtained.

Microclimatologists have developed adequate explanations for the phenomenon of temperature inversion within very small areas, and those conditions were apparently met during the periods of early killing frosts that we recorded in our experimental garden beds.

While our conclusions are still tentative in the sense that they must be replicated under more controlled conditions, we are confident for a number of reasons that the Wisconsin and Michigan garden beds built by unknown American Indians sometime over the last 2,000 years did, in fact, function in much the same way as smudge pots, sprinklers, and other devices in modern-day agriculture, to combat the threat of early killing frosts, in those northern climes.

The distributions of this kind of agricultural technique, the threat of early frosts in the area of their distribution, and the problems that early European farmers had, with frosts, all point to the conclusion that we reached in our experimental field.

But the mysteries of the prehistoric formal garden beds have by no means been solved. We still don't know who built them, how these early agronomists developed the idea of this type of combating device, or, for that matter, why they disappeared from the repertoire of Native American agricultural techniques.

Some researchers have suggested that the ridge-and-furrow type of agriculture has a long and complex history in North America, beginning with early attempts at the introduction of maize from South America into the American Southeast sometime before the birth of Christ. At Fort Center, Florida, William Sears has discovered large circular mounds that were apparently used for water drainage as long ago as the time of Christ. In the 1930s A. R. Kelly discovered ridges and furrows that may have been used for field drainage in Georgia. They were under a southeastern ceremonial mound that dated to the last century of the first millenium A.D. Finds of possible ridge-and-furrow agricultural fields have recently made by Ross Morell and Melvin Fowler in southern Illinois, dating to perhaps A.D. 1000.

It is possible, then, that the Wisconsin and Michigan fields may not be absolutely unique in eastern United States prehistory. In fact, the idea of mounding in long ridges might, at one time, have been a widespread technique used by different Indian groups to meet differing environmental conditions, ranging from flooding during the spring and autumn in the southeast, to frost drainage in the northern Great Lakes states. □

Opening day of Field Museum, May 2, 1921

Our Environment

Eight Crocodile Species Proposed for Endangered List

Eight crocodile species found in more than 40 countries around the world have been proposed for treatment as endangered species because they look like other crocodile species that are, in fact, listed as endangered.

The Endangered Species Act of 1973 allows a "similarity of appearance" treatment if law enforcement problems result from look-alike animals.

The eight species being proposed occur in Central and South America, China, and South and Southeast Asia. The force of American law does not, of course, extend to these foreign countries. American citizens, however, are forbidden under the law to trade or traffic in these animals, their parts or their products. None may be imported or exported to or from the United States.

The species are: the common caiman, brown caiman, dwarf caiman, smooth-fronted caiman, American crocodile (other than the Florida population which is already listed as endangered), Johnston's crocodile, New Guinea crocodile, and the saltwater crocodile.

This initiative is being taken by the U.S. Fish and Wildlife Service largely because of law enforcement problems caused by the inability to identify crocodile products at American ports of entry. The proposed eight species so closely resemble the eight species that are already listed that inspectors have substantial difficulty differentiating between the endangered species and the look-alike species, especially in the case of products made from their hides.

The differentiating characteristics of crocodilians are minute and often depend on the size and shape of the scales, their color, or the presence of follicle glands which are not readily apparent in processed hides. The color of most hides imported into the United State has been changed by preservation processes and tanning. Further, many products such as wallets, belts, and handbags have been dyed red, green, or brown, making it virtually impossible to positively identify the exact species.

Most Alligators off Endangered List

A significant wildlife conservation accomplishment was recognized recently when most of the nation's alligator populations were removed from the U.S. endangered species list. The alligator was removed from the endangered category and placed in the threatened category in all of Florida, and the costal portions of Georgia, Louisiana, South Carolina, and Texas. About 75 percent of the U.S. alligator population inhabits this area. The animal remains classed as endangered in all of Mississippi, Alabama, Oklahoma, and North Carolina, as well as inland areas of South Carolina, Georgia, Louisiana, and Texas.

An earlier action in 1975 had removed alligator populations in Louisiana's Vermilion, Cameron, and Calcasieu Parishes from the endangered list. The new rule will allow state and federal wildlife agency employees to capture and remove nuisance alligators. It also permits employees to kill nuisance animals if there is no place to relocate them. Twenty years ago the alligator was headed toward extinction. Improved management programs have brought it back.

Lake Erie May Never Be "Clean"

The Environmental Protection Agency (EPA) says that efforts to halt the algae growth caused by phosphorus pollution in the Great Lakes may be effective by 1985, but western Lake Erie will never be as "clean" as the other lakes, according to the Wildlife Management Institute.

Increases in the nutrient phosphorus, largely from human sources, going into Lake Erie have accelerated the natural process of eutrophication. If unchecked, this process could cause a lake to literally grow itself to death, becoming clogged with algae until decomposition of organic matter removed oxygen from the water and fish and other fauna could not survive.

According to research, there is a physical limitation to water quality improvement in the Great Lakes. Western Lake Erie, a small basin that collects water and phosphorus from a large area of land, has a calculated natural phosphorus concentration 50 percent higher than the next highest lake. This suggests that total removal of cultural wastes could never bring western Lake Erie to the levels possible in the other Great Lakes.

Spotted Owl Appears in Good Numbers

Bureau of Land Management biologists have located 193 nesting pairs of spotted owls in western Oregon, and only about 63 percent of the owl's habitat on BLM lands has been inventoried, the Wildlife Management Institute reports.

A total of 325 pairs have been found on all lands in western Oregon. That number probably will increase as the count progresses. It should exceed 400, which the Oregon Endangered Species Task Force Group has recommended as necessary to ensure the owl's survival. That group, made up of scientists from the Forest Service, Oregon Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and Oregon State University, believes that the existence of 400 pairs of the diminutive owls would make official listings as an endangered species unnecessary and would allow the bird's removal from the state's threatened species list. BLM's Oregon nongame biologist, Bill Neitro, says the critical elements for the spotted owl are nesting sites in decadent trees and small rodents for food.

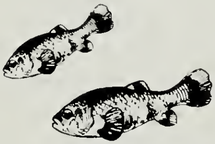
ENDANGERED AND THREATENED SPECIES
of the United States and Puerto Rico

The following table lists all fish, amphibians, reptiles, birds, and mammals of the 50 states and Puerto Rico that are currently classified as endangered (E) or threatened (T) by the U.S. Department of the Interior.

In addition to these vertebrates, many mollusks, insects, and plant species have also been proposed or are listed as threatened or endangered.

FISH

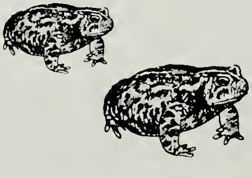
Shortnose Sturgeon	*Acipenser brevirostrum*	E
Longjaw Cisco	*Coregonus alpenae*	E
Lahontan Cutthroat Trout	*Salmo clarki henshawi*	E
Paiute Cutthroat Trout	*S. clarki seleniris*	T
Greenback Cutthroat Trout	*S. clarki stomias*	T
Gila Trout	*S. gilae*	E
Apache Trout	*S. apache*	T
Humpback Chub	*Gila cypha*	E
Pahranagat Bonytail	*G. robusta jordani*	E
Mohave Chub	*Siphanteles mohavensis*	E
Moapa Dace	*Moapa coriacea*	E
Woundfin	*Plagopterus argentissimus*	E
Colorado Squawfish	*Ptychocheilus lucius*	E
Kendall Warm Springs Dace	*Rhinichthys osculus thermalis*	E
Cui Ui	*Chasmistes cujus*	E
Scioto Madtom	*Noturus trautmani*	E
Devil's Hole Pupfish	*Cyprinodon diabolis*	E
Comanche Springs Pupfish	*C. elegans*	E
Tecopa Pupfish	*C. nevadensis calidae*	E
Warm Springs Pupfish	*C. nevadensis pectoralis*	E
Owens River Pupfish	*C. radiosus*	E
Pahrump Killifish	*Empetrichthys latos*	E
Big Bend Gambusia	*G. gaigei*	E
Clear Creek Gambusia	*G. heterochir*	E
Pecos Gambusia	*G. nobolis*	E
Unarmored Three-spine Stickleback	*Gasterosterus aculeatus williamsoni*	E
Gila Topminnow	*Paeciliopsis occidentalis*	E
Fountain Darter	*Etheostoma fanticola*	E
Watercress Darter	*E. nuchale*	E
Okaloosa Darter	*E. okaloosae*	E
Maryland Darter	*E. sellare*	E
Bayou Darter	*E. rubrum*	E
Snail Darter	*Percina tanasi*	E
Blue Pike	*Stizostedion vitreum glaucum*	E



DEVIL'S HOLE PUPFISH

AMPHIBIANS

Santa Cruz Long-toed Salamander	*Ambystoma macrodactylum croceum*	E
Desert Slender Salamander	*Batrachoseps aridus*	E
Texas Blind Salamander	*Typhlomolge rathbuni*	E
Houston Toad	*Bufo houstonensis*	E



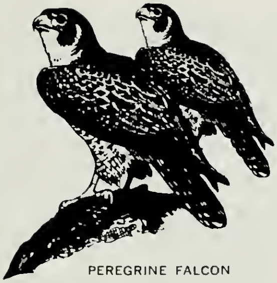
HOUSTON TOAD

REPTILES

American Crocodile	*Crocodylus acutus*	E
American Alligator	*Alligator mississippiensis*	E
Green Sea Turtle	*Chelonia mydas*	T
Loggerhead Sea Turtle	*Caretta caretta*	T
Hawksbill Sea Turtle	*Eretmachelys imbricata*	E
Atlantic Ridley Sea Turtle	*Lepidochelys kempii*	E
Pacific Ridley Sea Turtle	*L. olivacea*	T
Leatherback Sea Turtle	*Dermochelys coriacea*	E
Blunt-nosed Leopard Lizard	*Crotaphytus silus*	E
Puerto Rican Boa	*Epicrates inornatus*	E
San Francisco Garter Snake	*Thamnophilis sirtalis tetrataenia*	E

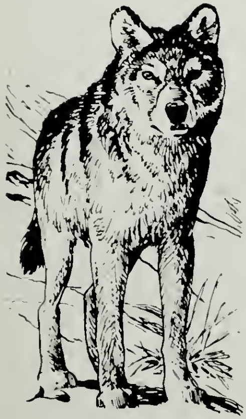
BIRDS

Newell's Manx Shearwater	*Puffinus puffinus newelli*	T
Hawaiian Dark-rumped Petrel	*Pterodroma phaeopygia sandwichensis*	E
California Least Tern	*Sterna albifrons browni*	E
Brown Pelican	*Pelecanus occidentalis*	E
Hawaiian Goose (Nene)	*Branta sandvicensis*	E
Aleutian Canada Goose	*B. canadensis leucopareia*	E
Laysan Duck	*Anas laysanensis*	E
Hawaiian Duck	*A. wyvilliana*	E
Mexican Duck	*A. diazi*	E
California Condor	*Gymnogyps californianus*	E
Florida Everglade Kite	*Rostrhamus sociabilis plumbeus*	E
Hawaiian Hawk	*Buteo solitarius*	E
Bald Eagle (lower forty-eight states)	*Haliaeetus leucocephalus*	E



PEREGRINE FALCON

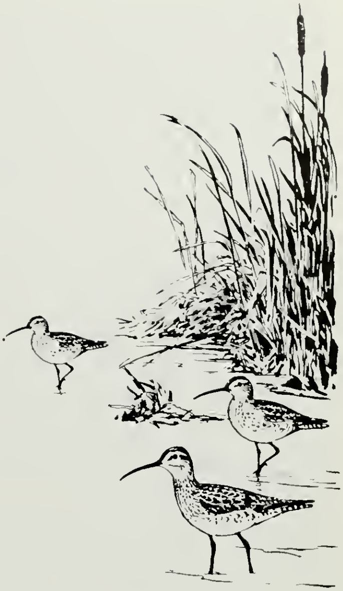
American Peregrine Falcon	*Falco peregrinus anatum*	E
Artic Peregrine Falcon	*F. peregrinus tundrius*	E
Attwater's Prairie Chicken	*Tympanuchus cupido attwateri*	E
Masked Bobwhite	*Colinus virginianus ridgwayi*	E
Whooping Crane	*Grus americana*	E
Mississippi Sandhill Crane	*G. canadensis pulla*	E
Yuma Clapper Rail	*Rallus longirostris yumanensis*	E
California Clapper Rail	*R. longirostris obsoletus*	E
Light-footed Clapper Rail	*R. longirostris levipes*	E
Hawaiian Gallinule	*Gallinula chloropus sandvicensis*	E
Hawaiian Coot	*Fulica americana alai*	E
Hawaiian Stilt	*Himantopus himantopus knudseni*	E
Eskimo Curlew	*Numenius borealis*	E
Puerto Rican Plain Plain Pigeon	*Columba inornata wetmorei*	E
Puerto Rican Parrot	*Amazona vittata vittata*	E
Puerto Rican Whip-poor-will	*Caprimulgus noctitherus*	E
Red-cockaded Woodpecker	*Dendrocopus borealis*	E
Ivory-billed Woodpecker	*Campephilus principalis*	E
Hawaiian Crow	*Corvus tropicus*	E
Small Kauai Thrush	*Phaeornis palmeri*	E
Large Kauai Thrush	*P. obscurus myadestina*	E
Molokai Thrush	*P. obscurus rutha*	E
Nihoa Millerbird	*Acrocephalus kingi*	E
Kauai Oo	*Moho braccatus*	E
Crested Honeycreeper	*Palmeria dolei*	E
Akiapolaau	*Hemignathus wilsoni*	E
Kauai Akiola	*H. procerus*	E
Kauai Nukupuu	*H. lucidus hanapepe*	E
Maui Nukupuu	*H. lucidus affinis*	E
Hawaii Adepa	*Loxops coccinea coccinea*	E
Maui Akepa	*L. coccinea ochraceu*	E
Oahu Creeper	*L. maculata maculata*	E
Hawaii Creeper	*L. maculata mana*	E
Molokai Creeper	*L. maculata flammea*	E
Po'o Uli	*Melamprosops phaesoma*	E
Laysan Finch	*Psittirostra cantans cantans*	E
Nihoa Finch	*P. cantans ultima*	E
Ou	*P. psittacea*	E
Palila	*P. bailleui*	E
Maui Parrotbill	*Pseudonestor xanthorphys*	E
Bachman's Warbler	*Vermivora bachmanii*	E
Kirtland's Warbler	*Dendroica kirtlandii*	E
Dusky Seaside Sparrow	*Ammospiza maritima mirabilis*	E
Cape Sable Sparrow	*A. maritima nigrescens*	E
Santa Barbara Song Sparrow	*Melospiza melodia graminea*	E



NORTHERN ROCKY MOUNTAIN WOLF

MAMMALS

Hawaiian Bat	*Lasiurus cinereus semotus*	E
Gray Bat	*Myotis grisescens*	E
Indiana Bat	*M. sodalis*	E
Utah Prairie Dog	*Cynomys gunnisoni*	E
Delmarva Peninsula Fox Squirrel	*Sciurus niger cinereus*	E
Morrow Bay Kangaroo Rat	*Dipodomys heermanni morroensis*	E
Salt Marsh Harvest Mouse	*Reithrodontomys raviventris*	E
Sperm Whale	*Physeter catodon*	E
Pacific Gray Whale	*Eschrichtius robustus*	E
Finback Whale	*Balaenoptera physalus*	E
Sei Whale	*B. borealis*	E
Blue Whale	*B. musculus*	E
Humpback Whale	*Megaptera novaeangliae*	E
Right Whale	*Balaena glacialis*	E
Bowhead Whale	*B. mysticetus*	E
San Joaquin Kit Fox	*Vulpes macrotis mutica*	E
Northern Swift Fox	*V. velox hebes*	E
Red Wolf	*Canis rufus*	E
Eastern Timber Wolf	*C. lupus lycaon*	E
Mexican Wolf	*C. lupus baileyi*	E
Northern Rocky Mountain Wolf	*C. lupus irremotus*	E
Grizzly Bear (lower forty-eight states)	*Ursus arctos horribilis*	T
Black-footed Ferret	*Mustela nigripes*	E
Eastern Cougar	*Felis concolor cougar*	E
Florida Panther	*F. concolor coryi*	E
Ocelot (in U.S.)	*F. pardalis*	E
Margay (in U.S.)	*F. wiedii*	E
Jaguar (in U.S.)	*Leo onca*	E
Hawaiian Monk Seal	*Monachus schauinslandi*	E
Florida Manatee	*Trichechus manatus latirostris*	E
Key Deer	*Odocoileus virginianus clavium*	E
Columbian White-tailed Deer	*O. virginianus leucurus*	E
Sonoran Pronghorn Antelope	*Antilocapra americana sonoriensis*	E
Wood Bison	*Bison bison athabascae*	E



ESKIMO CURLEW

Life in Ancient Peru

Studying the 4,000-year-old rubbish of a Peruvian coastal people may provide insights into the origins—and future—of human civilization

By Robert A. Feldman

Agriculture has been the mainstay of life in South America for more than 3,000 years, and because of its importance archaeologists are actively concerned with the origins and consequences of plant domestication. The Field Museum's recent exhibition "Ancient Ecuador: Culture, Clay and Creativity" (opened April 1975) dealt with the consequences of agriculture in Ecuador. In the catalog for that exhibit, research associate Donald W. Lathrap wrote:

> civilization cannot appear until a truly productive agricultural system has been developed. Large groups of city dwellers who are not producing their own food can be fed only after really efficient patterns of agricultural production have been envolved. It is an urban population that provides the context for craft specializations, a large professional priesthood, a professional military, a bureaucracy, and finally writing—the various characteristics by which we define civilization.

While this statement is certainly true for the elaboration

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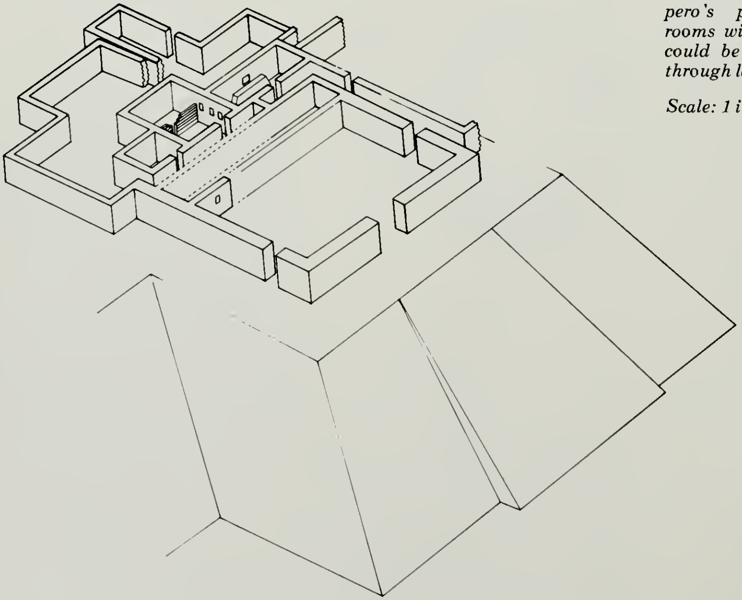
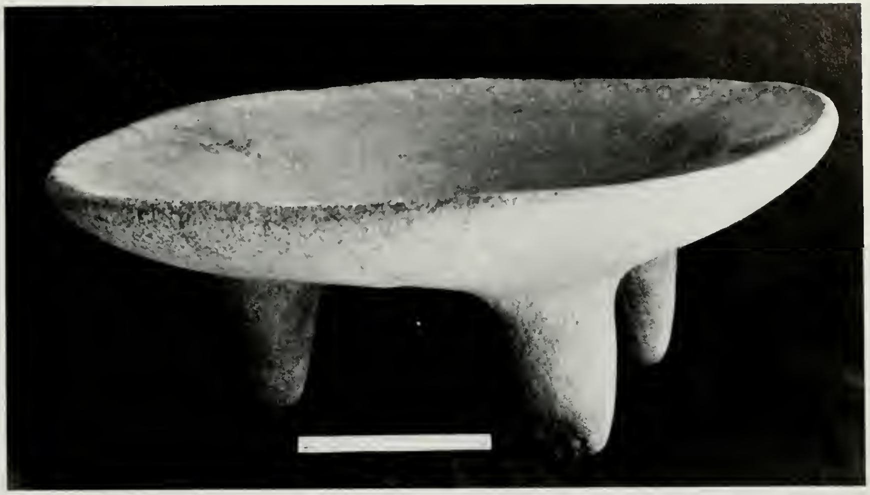


Simplified reconstruction drawing of a late phase of Huaca de los Idolos (ca. 2750 B.C.) shows the large size of Aspero's public architecture. Central rooms with clay frieze and wall niches could be reached only by first going through larger entry rooms.

Scale: 1 inch = 10.3 meters

This finely made footed grindstone (ca. 2750 B.C.) capped a dedicatory burial on Huaca de los Sacrificios. Stonework of this quality had previously been thought to begin at least 500 years later, in early pottery-using times.



and florescence of civilization—and indeed for its very origins in most areas of the world—it does not hold with equal force for the central coast of Peru, that stretch along the Pacific Ocean from Lima to Chimbote, some 400 km to the north. There, the unusual richness of the sea allowed large concentrations of people to form stable villages in which the day-to-day contacts and conflicts of the residents resulted in the formation of the rules and controls that formed the basis of later Peruvian civilization.

Behind this seemingly minor point lurks a concept of great importance: it was not agriculture, in and of itself, that created civilization, but rather the large, stable communities that agriculture can support. If another stable, adequate food source is at hand, such as the marine and littoral resources of the central Peruvian coast, then the complex developments leading to civilization can take place.

During the first half of 1974, I directed excavations at the preceramic settlement of Aspero, in the Supe valley about 175 km to the north of Lima. Aspero is a large *midden,* or archaeological site composed of shells, fish bones, ash, sand, cooking rocks and other habitational garbage. The extreme dryness of the Peruvian coast creates a near-ideal situation for archaeology, with excellent preservation of the organic remains that rapidly decompose in more humid environments, though one can have too much of a good thing—the garbage still smells after 4,000 years! (A colleague once remarked that the great quantity of peanut shells in another midden reminded him of Yankee Stadium after a double header.) As a result of the excellent preservation, we can easily find what the prehistoric people were eating and can recover craft items such as textiles, fish nets, and gourd containers.

The cause of the desert dryness is a set of cold ocean currents that moving northward, cool the winds off the ocean and thus prevent rainfall. These currents are also responsible for an upwelling of nutrient-rich water from the ocean depths that creates one of the richest marine environments in the world, supporting millions of tons of anchovies. The ancient Peruvians made nets of plant fiber, including (after 3,000 B.C.) domesticated cotton, and easily harvested enough fish to support large, stable communities of hundreds of families.

Additional food came from the abundant colonies of mussels and clams on the beaches, from the birds and sea lions that preyed on the anchovies, and from the animals and plants that inhabited coastal marshes and river bottoms. In rare years abnormalities affected the currents and stopped the upwelling, thus dispersing the anchovies and poisoning the shellfish with red tides.* Rains also fell on the normally bone-dry land, so that when the sea failed, the desert bloomed, and though the times were hard, the coastal peoples survived and prospered.

The preceramic inhabitants of Aspero were not just happy fisherfolk who passively enjoyed the bounties of nature. Within their stable community they developed specialized crafts, engaged in trade over great distances,

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*Red tides are massive concentrations of toxic microorganisms that color the seawater red.

and erected monumental public buildings—in other words, these nonagricultural peoples were developing the bases of civilization.

How does the archaeologist know these things about a people dead for 4,000 years? At this point in time we must be content with the material remains of their actions, interpreting their form and distribution by analogy with recent cultures or by using the complexity or scale of the artifact as a reflection of the people behind it. Several lines of evidence must be brought together, not just from one site but from many.

For example, two small stone beads I found at Aspero—very finely shaped and made of a distinctive heat-treated red flint, a difficult material to drill small holes through—were interesting but not very enlightening in themselves. However, beads of the same stone and same fine workmanship were found at another preceramic site some 65 km south of Aspero. We can now see that the beads at both sites were probably made by the same person, a craft specialist who traded his wares from one settlement to another. The beads were not the only evidence for trade. Screening the midden yielded a small fragment of *Spondylus* seashell, whose nearest source is the tropical waters of southern Ecuador, some 1,300 km to the north.

Other foundations of civilization were also being laid. The most common artifacts that I found were cotton textiles. Preceramic textiles were usually twined rather than woven, and thus different in technique from the later tapestries and embroideries for which Precolumbian Peru is so noted; but their basic designs and such iconographic elements as symmetrical repetition of motifs and creatures such as snakes, birds, and composite-animal "monsters" first appeared in the preceramic. The central role of textiles in ceremonies, noted among the Incas, can also be seen in the preceramic. Offerings of burnt textiles placed below the floor were used to consecrate houses and temples; textiles were the most common item placed in graves with the dead, and their manufacture engaged a major part of the work of the inhabitants of Aspero.

They also built large public structures, which one is tempted to call "temples," but this word is too loaded with connotations. I have instead called them "huacas," an Inca world for a sacred building, object, or place, but which is now applied by archaeologists to any prehistoric mound. Whatever one labels them, it is clear that these mounds were not ordinary buildings. The largest, Huaca de los Idolos, was more than 30 by 40 meters at its base and 10 meters high. Two others were of comparable size,

Field Assistant Paul Espinosa finishes excavation of the wall frieze in the central room of Huaca de los Idolos. Rock rubble above was part of fill intentionally placed in the room prior to a rebuilding.

Huaca de los Sacrificios prior to its excavation gave little indication of the elaboration of its internal architecture.

while there were more than half a dozen smaller mounds.

When we consider the amount of work that went into building the huacas, it appears that a tremendous amount of labor was spent on tasks that brought no immediate benefits to the workers. Rooms were repeatedly rebuilt, while the old ones were partially filled in to add to the height and impressiveness of the supporting mound. The rebuildings were not needed to repair old or damaged construction; even today, after 4,000 years, the plaster still looks fresh. I feel that the rebuildings were done ceremoniously, either on a regular basis or as part of special observances of human or natural events. The labor invested was consciously expended in an extravagant manner, as if to say to the world "Look what we are capable of."

While it is doubtful that there was a full-time priesthood or bureaucracy running the show, the regularity and formality of the huacas tell us that someone was in control. This is a very significant point. One of the most important features of civilization, especially in the Andes of Peru, is that it allows a few to direct the labor of many. The pyramids of Egypt would never have been built if a committee had been in charge of the construction!

A basic feature of Andean statecraft, as shown to us by Spanish accounts of the Inca, was that taxation was in the form of labor, not goods or money. Thus, a man might have to serve in the army, or cultivate an acre of corn, or help repair a suspension bridge to pay his taxes; a woman would often be given a quantity of the state's wool to weave into cloth, her labor paying her share of her family's taxes. The huacas at Aspero show us that 3,000 years before the Incas started their conquest of the Andean world, people were giving their labor to community projects, establishing the basic economic underpinning of Andean government.

Andean religion also traces some of its many roots back to the preceramic. The fantastic beings shown on some preceramic textiles are unmistakably related to later "deities." The wall niches, painted murals, and clay friezes that decorated the walls of the preceramic huacas continued to be important, even diagnostic, features of public buildings.

The building of huacas by centrally controlled labor groups in the preceramic might have remained just an interesting footnote to prehistory if it were not for developments that occurred at the end of the preceramic: people began to grow more of their food. While the reasons for the shift from marine fishing and collecting to farming are not yet fully known, a major factor appears to have been geological uplift of the coast, which drained the shallow bays and lagoons fished by the preceramic peoples. They were thus forced to rely more on agriculture to feed themselves.

But this change was not simple. Naturally watered farm land is rare on the desert coast, and most of that was already being used to grow cotton for textiles and nets and gourds for net floats and containers. Irrigation was needed, but to build irrigation canals requires large labor investments and a centrally coordinated work force. These were the very features developed in building the huacas. In a sense, the preceramic peoples were "preadapted" for irrigation agriculture. They were thus able to rapidly open up areas of the desert and to quickly surpass the level of development attained in the preceramic, moving on to civilization.

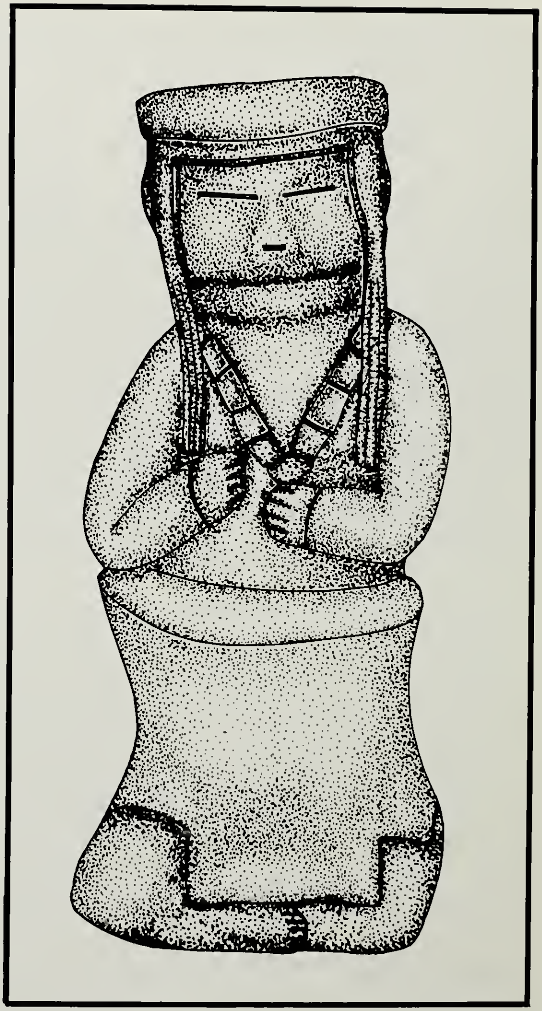
It is a fact of archaeological life that spectacular or impressive finds are few and far between. Thus, I was very lucky to encounter two such finds at Aspero. While clearing the dirt from along a wall on the Huaca de los Sacrificios, I started to discard a "loose" stone, and found to my surprise that it would not move. Clearing further, I discovered to my delight that it was really one of four legs of a finely made grindstone that covered the body of a late fetal or newborn infant adorned with more than 500 beads and two unusually large twined textiles. The burial had been carefully placed on the floor. More work revealed a second burial, this time an adult placed in alignment with the first.

The infant burial was obviously important, but what did it signify? Grave goods other than a few textiles or gourd bowls are rare in the preceramic, especially with infants, who were often simply interred in the garbage. It appears that the burials were related to the huaca, as a dedication or consecration of the structure. We know that children and llamas were sacrificed by the later coastal peoples to dedicate important structures. That the Aspero burials had a similar intent is supported by my second find: a cache of clay figurines.

Fragments of human figurines made of unfired clay had been found at other preceramic sites, so when one of the workmen began finding smoothed lumps of white clay among an unusual concentration of basketry, matting and other plant material in a small room on the Huaca de los Idolos, I instructed him to be particularly observant. The diligence paid off, as the torso and head of a little figure was soon recovered from the cache. In all, pieces of over a dozen figurines, as well as several pounds of clay lumps, were found. Most represented females, some of which appear to be pregnant. The figurines are all very similar to each other—probably the product of only one artist—but different from the figurines found at other preceramic sites.

The other contents of the cache are the same as those found in burial bundles at another settlement, where a preceramic cemetery has been excavated. It is interesting to note that some of the bundles contained no bodies, but only plant material. By analogy to this site, we can conclude that the figurines at Aspero are symbolic of sacrifices, and served to consecrate a new phase of building in the huaca.

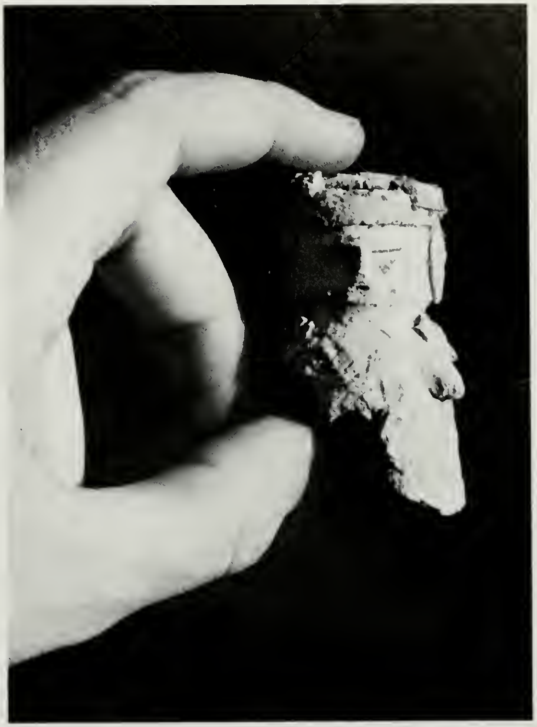
Besides giving us this important glimpse of preceramic ceremonial activity, the figurines provide us with our first picture of the type of clothing worn. Large numbers of textiles have been found in the past, but most were fragmentary and none gave any clear indication of how they were used. The largest Aspero figurine, a male, is shown wearing a bead necklace (portraying the same type of red bead as the two I found), a hat with tassels or



Reconstruction of an Aspero figurine shows a seated man wearing a wrap-around skirt, tasseled hat, and bead necklace. Figurines from the cache in Huaca de los Idolos provide the first evidence of what early Peruvian clothing looked like when worn.

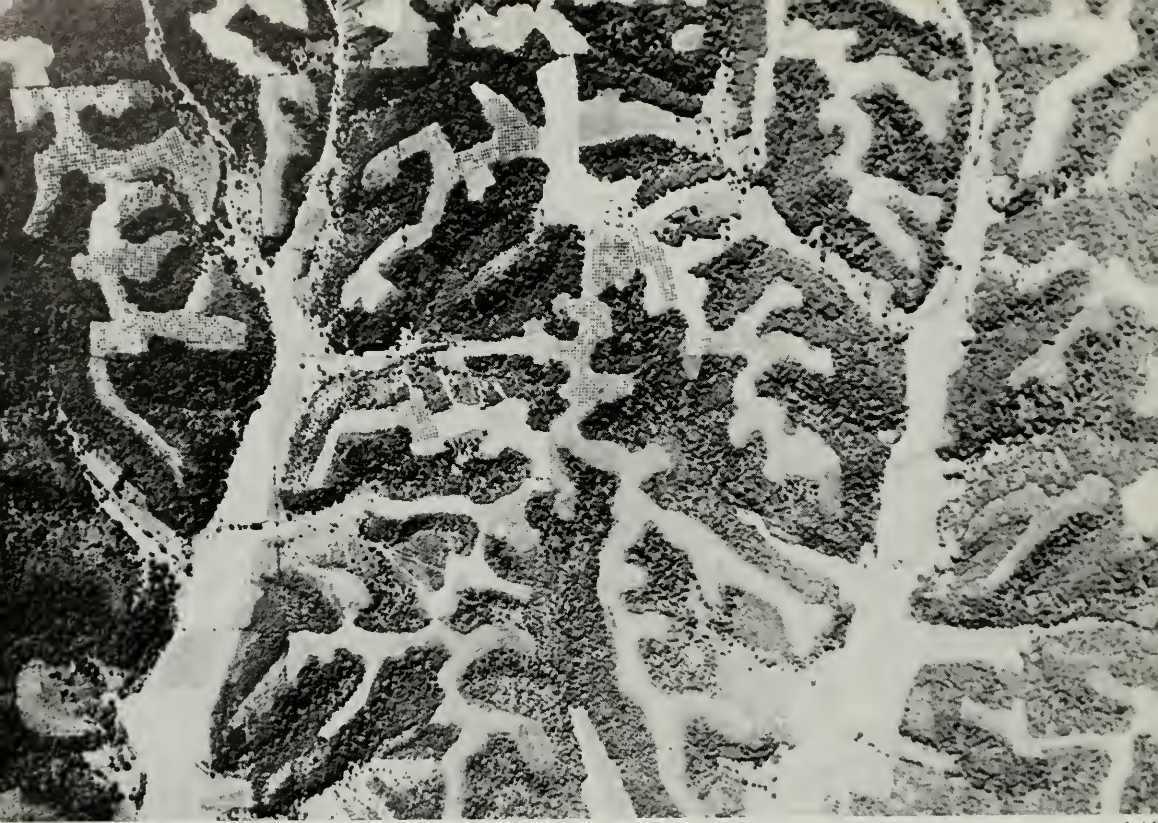
bands falling down over the shoulders, and a peculiar skirt or kilt, swept out above the waist. Other figurines show body paint and beaded wristlets, in addition to the necklace and hat.

Evidence gathered by the excavations at Aspero show that settled village life, craft specialization, the construction of monumental public architecture, and the division of society into separate classes were all well developed in coastal Peru prior to 2,500 B.C. These important developments were similar to those taking place at the same time in the Valdivia culture of Ecuador; but significantly, unlike in Ecuador, where maize agriculture formed the subsistence base of society, Aspero was supported in the main by marine resources. It thus appears that it was not agriculture, *per se,* that led to civilization, but rather large groups of people living in close proximity for extended periods of time. By comparing the paths toward civilization in these two areas, we can begin to isolate the important forces that were at play in all areas, and develop a general theory of the origins—and hopefully, the future course—of civilization. In this way we can use the past to illuminate the present and point toward the future.



Small female figurine was the first found. Most of the figurines in the cache were female, some of which were represented as pregnant. ➤

Massive size of rock walls forming Aspero mounds indicate that they were built by large organized work groups. The patterns of labor control developed during the preceramic formed the foundations of later Andean economic life. ▼



Jack V

Aerial photo of the rolling hill country of western Illinois reveals the pattern of land use. Forests survive only on ridge tops too steep for cultivation, while the valleys are farmed. In the center of the picture, where the canopy is discontinuous and the forest floor visible, pasturing and/or selective logging is taking place.

Looking for 'Unimproved' Land: The Illinois Natural Areas Inventory

By Mike Madany

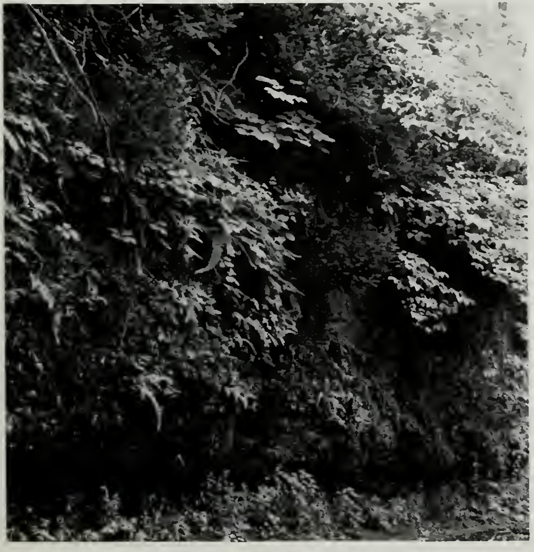
Mike Madany is a field assistant for the Illinois Natural Areas Inventory.

About twenty years ago Illinois residents began to do more than just fret about the future of their state's natural areas—the dwindling prairies, forests, swamps, and marshes. Since its organization in 1957, the Illinois chapter of the Nature Conservancy, notably, has played a big role in preserving more than 6,000 acres of such natural land.

The Illinois Nature Preserves Commission, created in 1963, has with the Illinois Department of Conservation and private organizations such as the National Land Institute of Rockford, purchased and preserved numerous areas. As a result, the strict regulations safeguarding all dedicated Illinois nature preserves now cover more than 23 square miles of public and private land.

All of these organizations are, however, hampered by severe limitations of staff and of money for purchasing land. Much of the time they are forced to react in crisis situations: a certain natural area is threatened by industrial or agricultural interests, so a local conservation group becomes aware of the planned development and

Above, left: *The rugged topography of the Mississippi River bluffs in south-central Illinois have resisted human abuse better than the state's more productive areas. Here, at Fults Hill Prairie, red cedar and shortgrass prairie plants struggle for survival in the thin, dry, rocky soil.* **Below, left:** *Bedrock exposure, such as this in Winnebago County, provides habitat for numerous rare plant species, including relics of past plant migrations.* **Above, right:** *Cuckoo flower (*Cardamine pratensis palustris*) was unknown in Illinois prior to the summer of 1975, when Keith Wilson, a INAI field worker, discovered it in a number of bogs near the Wisconsin border.* **Below, right:** *One of the most unusual areas discovered by the INAI in Illinois is this system of calcareous seep springs in McHenry County. Here "islands" of prairie dock (*Silphium terebinthinaceum*), with grass-of-Parnassus (*Parnassia glauca*) at their base, are surrounded by continuously flowing seepage water that discharges from the surrounding moraines. (Photos by Marlin Bowles, Illinois Dept. of Conservation.)*



mounts a campaign for preservation. By the time one ot these agencies intervenes there is usually an adversary relationship — a situation hostile to the prospects of positive settlement. The owner may have favored preservation a few years ago but now he can realize a considerable profit from his development and is not open to other suggestions. The only solution then is condemnation, and this can be done only by government action.

To compound the problem, agencies such as the Illinois Nature Preserves Commission and the Department of Conservation strive to preserve representative samples of different natural communities. When making decisions on acquiring land they must take into account replication of existing preserves and the rareness of the threatened area, all within the context of a limited land acquisition budget. Is this endangered tract indeed the "last virgin tamarack bog," or is there a much better example of the same type of community just a few miles away that has escaped attention?

It was with these problems as a backdrop that the Illinois Natural Areas Inventory was launched in early 1975. The purpose of the three-year project was ambitious — to locate and describe the significant natural areas of the state. Funding for the Inventory is supplied under a $654,000 contract from the Department of Conservation to the Department of Landscape Architecture of the University of Illinois at Urbana-Champaign in conjunction with the Natural Land Institute. The federal Bureau of Outdoor Recreation is providing partial reimbursement of funds to the Department of Conservation.

The main objective of the project is to provide data for a comprehensive plan to preserve natural areas in the state. It is intended to realize optimum benefit from the limited public acquisition dollars and will include natural areas in regional plans and environmental impact statements.

The first months of the project's existence were dedicated to training the staff of five field ecologists and refining the methodology for the survey. Research was carried out to determine the value of various aerial photographs, vegetation maps, and soil maps for determining areas of high potential for natural areas.

After field-testing the procedures of the survey, the various techniques were honed down to the essentials. Thoroughness had to be commensurate with the three-year time limit and the immensity of the task. The term

Field assistant Rob Moran records plant species occurrence within a ¼-meter quadrat hoop. By comparing the relative density of different species, field workers can get an idea of both the quality of individual prairie communities and significant differences between prairie types. Since one of the purposes of the Illinois Natural Areas Inventory is to preserve representative examples of each indigenous natural community, it is essential to know how to separate different communities by objective scientific methods. (Photo by Jerry Paulson.)

"natural area" was defined for the Inventory's purposes as a place which fulfilled at least one of the following qualifications:

- An area with relatively undisturbed natural communities or, in cases where certain existing communities are so rare that none is of high quality, the best remaining example.
- An area that provides habitat for endangered plants and animals.
- An area where plants or animals occur as relict populations, at least 100 miles from the species' general range.
- An area which exhibits outstanding geological features.
- An area used by schools for teaching and research.

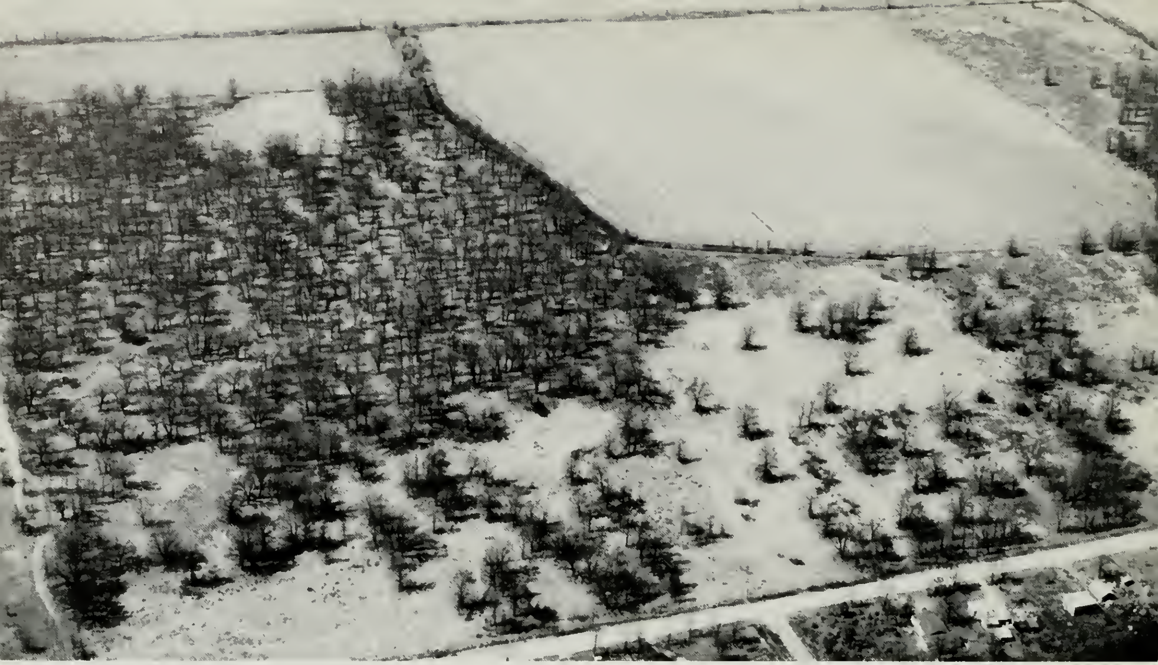
In the fall of 1975, INAI conducted a separate search for railroad right-of-way prairies. Autumn was the best time for such work since the native prairie grasses then turn bright shades of gold and red that contrast strongly with the longer-lasting greens of alien grasses and weeds. The fieldworkers flew more than 7,000 miles of track at low altitudes and selected more than 700 potential prairie sites. Promising areas were investigated on foot and they discovered 104 separate stretches of high quality prairie totalling 191 acres.

Railroad prairies are among the fastest disappearing of natural areas in the state. While the survey was being conducted several potential sites were destroyed. Some of this damage was caused by construction or improvement of railbeds; some was caused by the enlargement of agricultural fields adjacent to the right-of-way. Herbiciding of right-of-ways for maintenance, ostensibly to kill brush and weeds, has ruined many miles of prairie; ironically, these spots are converted to solid stands of hardy Eurasian weeds.

The arrival of winter found the INAI staff busy preparing for the following summer's main assault. Conservation groups and knowledgeable individuals were contacted to provide information on existing natural areas and stations for rare plants and animals. Thousands of aerial photos were studied at county offices of the Agricultural Stabilization and Conservation Service. Potential natural area—noncultivated land and forests with little evidence of logging or grazing—were noted on both topographic maps and county road maps.

After this background research, many hours of airtime were spent checking these potential natural areas and the field workers developed a variety of clues in their aerial sleuthing. An uneven forest canopy, for instance,

Survey director Jack White wades past a beaver lodge in a southern Illinois bottomland swamp. Some of the largest tracts of virgin timber in Illinois occur in such regions along the river valleys. (Delayed shutter photo by Jack White.)



*Aerial view of black oak (*Quercus velutina*) savanna on a sand dune in Pembroke Township, Kankakee County. The open structure of the canopy and the grass-covered understory indicate a relatively undisturbed community. (Photo by John Bacone.)*

suggested logging in the not too distant past. Long lateral lines in a prairie indicated that the area may once have been under cultivation. A marsh covered by a solid stand of cattails might have been an area with an altered water level.

Each area that survived aerial scrutiny was visited on foot by a fieldworker and further checked for signs of disturbance. Each step of the process was designed to leave only those areas which met the size and quality standards of the INAI. At the outset of the Inventory it was decided that the minimum size for forests or wetlands would be 20 acres, while for prairies, areas down to one-quarter acre would be recognized. The standards for quality took into account lack of alteration of the water level, degree of disturbance to the soil profile, and the composition of the vegetation itself.

June 1, 1976, marked the beginning of a new phase of INAI activity as the five district representatives converged on the headquarters in Urbana along with eight summer employees to begin an intensive two-week training session. The trainees learned how to use the vegetation sampling equipment and were familiarized with the forthcoming summer's work. For each natural area that would be visited, a four-page "final field survey form," covering everything from location and ownership to type of plant communities and history of use, would be filled out. To ensure uniform results, the workers were drilled intensively on the proper way to fill in each of the 80 different parts.

The following three months were exceptionally active as the two-person teams visted each natural area identified the prior winter. Each district representative was expected to finish one-half of the counties in his district. Counties differed greatly in the amount of natural areas; some, especially those in the heavily agricultural center of the state, were nearly devoid of natural areas, while others, especially in the rugged topography and poor soils of the south and northeast, were dotted with natural areas.

A typical day for the field crew might begin at 6:30 in some small-town motel. Forms, species checklists, aerial photographs, and topographic maps are gathered and loaded into the car along with soil probes, wedge prisms, rangefinders, compasses, slope meters, increment borers, measuring tape, and aluminum quadrat hoops. After breakfast the crew speeds to its destination. If today's natural area is on private land, the workers must find the owner and secure permission to enter.

The first step in "doing" a natural area is tramping its length and breadth to determine its boundaries. This data is recorded on acetate overlays taped to aerial photos. The location of other features — trails, fences, powerlines. buildings, colonies of rare plants — and the extent of various natural communities is also ascertained and recorded. After a morning of preliminary investigation the team repairs to a local cafe.

Here the conversation is as rife with jargon as that of the truckers sitting in the next booth. "Well, do you think that place will qualify as a category II natural area? Or should we put *Hypericum adpressum* down as an exceptional feature?"

"Did you see the *Quercus velutina*? It had to be a Class 9."

"Hey, that *Juncus* I thought was *vaseyi*—it just keyed out to a weird form of plain old *dudleyi.*"

While waiting for dessert to be served one of the crew might be copying down 20 random numbers from a statistical table to ensure the objectivity of the vegetation sampling that afternoon.

Vegetation sampling can be at times the most frustrating and time-consuming activity of the final field survey. If the team is recording the contents of a series of 20 circular plots in some northern Illinois sedge meadow, trying to remember whether the bluish-green leaves belong to *Carex haydenii* or *Carex Buxbaumii* can be indeed vexing, especially on a hot, humid, windless day. On the other hand, there is no telling what one will find while vegetation sampling. Perhaps there will be a new plant discovery for the county in the next plot. Or, better yet, the next few steps may lead to a species new to the state or even the ultimate — a plant thought to be extinct in Illinois.

In forests the procedures are more complicated. Looking through a square of specially prepared glass known as a wedge-prism gives a quick approximation of which trees were dominant in terms of basal area. Density of trees within different size classes is ascertained with the aid of a rangefinder and measuring tape. At alternate points the types and numbers of shrubs and saplings within a given radius are recorded. When the natural area is finally sampled, graded, and mapped to the prescribed degrees of accuracy, the team can return to its base and begin an evening of work. The sampling data must be tabulated and analyzed, the final field survey form must be filled out and grades determined for the natural communities. Tomorrow promises another natural area, the possibility of earthshaking finds — and the same routine.

As August began, plans were completed for another separate survey—this time for cemetery prairies. A cemetery which was established on the original prairie sod during pioneer times may contain a patch of relatively undisturbed prairie. The Inventory received the cooperation of noted prairie expert Robert Betz (a Field Museum research associate). Betz had pioneered work with cemetery prairies by visiting more than 900 of them in northern Illinois over the past 10 years and initiating preservation action for 30 areas. With those cemeteries visited by Betz studied and evaluated, there remained more than 3,000 other cemeteries to be checked for prairie remnants.

To carry out this herculean task, an army of 87 volunteers was marshalled to cover the 93 counties having potential for prairie. These volunteers spent the weekends of August and September driving down dusty roads searching for clumps of spruce or some other clue to the presence of the cemetery marked on the map. The volunteers found that most cemeteries had lost all but the most tenacious prairie plants, thanks to careful manicuring and mowing by caretakers. However, here and there were patches of unplowed, ungrazed prairie—often the only natural prairie vegetation in the county. A total of 138 cemeteries were found to have some potential for preservation and management; 27 of these were of sufficient size and quality to be designated natural areas.

What has the Inventory accomplished so far? About half the work has been completed; in the end, a total of 1,000 areas probably will be inventoried. In addition to finding many areas previously unknown to preservation organizations, the fieldworkers have discovered five species of plants new to Illinois and scores of county records, thus updating distribution data for many rare species. No other state has undertaken an inventory of natural areas as detailed as this. If a given area is preserved, the masses of information gathered during the survey will serve as valuable benchmark data for future studies.

However, one disturbing trend was discovered in the course of the past year's work: In every part of the state the continual destruction of natural land has been documented. Upon completion of the survey, data about natural areas that has been collected will be placed in a computer and cross-referenced so that local agencies involved in land preservation can readily retrieve the desired information. The Illinois Department of Conservation plans to expand a program to encourage preservation of the areas, and the computerized system will be invaluable for setting priorities. It is essential, however, that the information gathered by the Inventory be used as speedily as possible so that the computerized file will not become merely a historical memento. ☐

For locating certain categories of natural areas there is no substitute for cooperation from the public. This is especially true for small areas and habitats of endangered species. Persons with information which could be of value to the INAI may write: Illinois Natural Areas Inventory, 214 Mumford Hall, University of Illinois, Urbana, Il 61801. Phone (217) 333-2200.

June and July at Field Museum

(June 15 through July 15)

Special Exhibits

Treasures of Tutankhamun—through August 15. This exhibit, on loan from the Egyptian government, features a dazzling display of 55 of the most beautiful and best-preserved objects from the tomb of the pharaoh who lived 3,300 years ago. Among these are the startling golden effigy of Tutankhamun, the graceful gilt statuette of the goddess Selket, a gilded figure of the young pharaoh harpooning, and a small gold shrine of exquisite craftsmanship. The exhibit also includes superb examples of Tutankhamun's funerary jewelry, furniture, writing materials, musical instruments, games, and decorative objects of alabaster and ivory. (Cosponsored by the University of Chicago's Oriental Institute.) Monday through Wednesday, 9 a.m. to 6 p.m.; Thursday through Sunday, 9 a.m. to 9 p.m.

The Magic of Egyptian Art—through August 15. A supplementary exhibit at the Oriental Institute, 1155 East 58th Street, runs concurrently with the Tutankhamun exhibit at Field Museum. It features artifacts from the Oriental Institute's permanent collection, including objects used in the actual embalming of Tutankhamun and at his funerary banquet. Tuesday through Saturday, 10 a.m. to 4 p.m.; Sunday, 12 noon to 4 p.m.

New Programs

Summer Journey for Children: Spelunking—through August 31. Self-guided tour for children (with or without parents) leads them to exhibits that exemplify the geology and biology of caves. The *Journey* poses numerous questions about caves. among them are: In what type of rock are caves found? How do cave environments differ from others? What animals live in caves? *Journey* sheets are available at the information booth, main floor.

Audio Information System. The museum's newly installed audio system, Uniguide, enables visitors of all ages to visit as many as 50 selected exhibits in any sequence they choose. Complete with background music, sound effects, and factual information supplied by the museum's scientific and education staff, this system provides an entertaining as well as educational experience. Specially designed audio receivers and maps are available for a nominal fee at the entrance to the Museum Shop, main floor.

Continuing Exhibits

Male and Female: Anthropology Game. This fascinating game/exhibit of 39 artifacts lets you play anthropologist. Look at the artifacts and decide whether they were used by men or women. Discover that economic and social roles of men and women are not universally the same. Game scorecards are available. Elevator lobby, ground floor.

The Place for Wonder. This gallery provides a place to feel, try on, handle, sort, and compare natural history artifacts and specimens. The possibilities are endless—and so are the chances to ask questions and get answers. (Trained volunteers are on hand to help and guide in exploration.) Opens promptly each day of the week at 10 a.m., 11 a.m., 1 p.m., and 2 p.m.; on Saturdays and Sundays the gallery also opens at 3 p.m. Located near the new cafeteria, ground floor.

Man in His Environment. This exhibit takes a global view of some of the most serious environmental problems confronting all mankind and asks visitors to involve themselves in these problems —and the need for solution. Hall 18, main floor.

Continuing Programs

Weekend Discovery Programs. Saturdays and Sundays, 10 a.m. to 3 p.m.: take tours, follow demonstrations, participate in museum-related activities.

The Ancient Art of Weaving. Members of the North Shore Weavers' Guild demonstrate weaving and spinning every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

Museum Hours Now through August 15

The Museum Opens daily at 9 a.m., closes at 6 p.m. Monday through Wednesday and 9 p.m. Thursday through Sunday. On Fridays, year-round, the museum is open to 9 p.m.

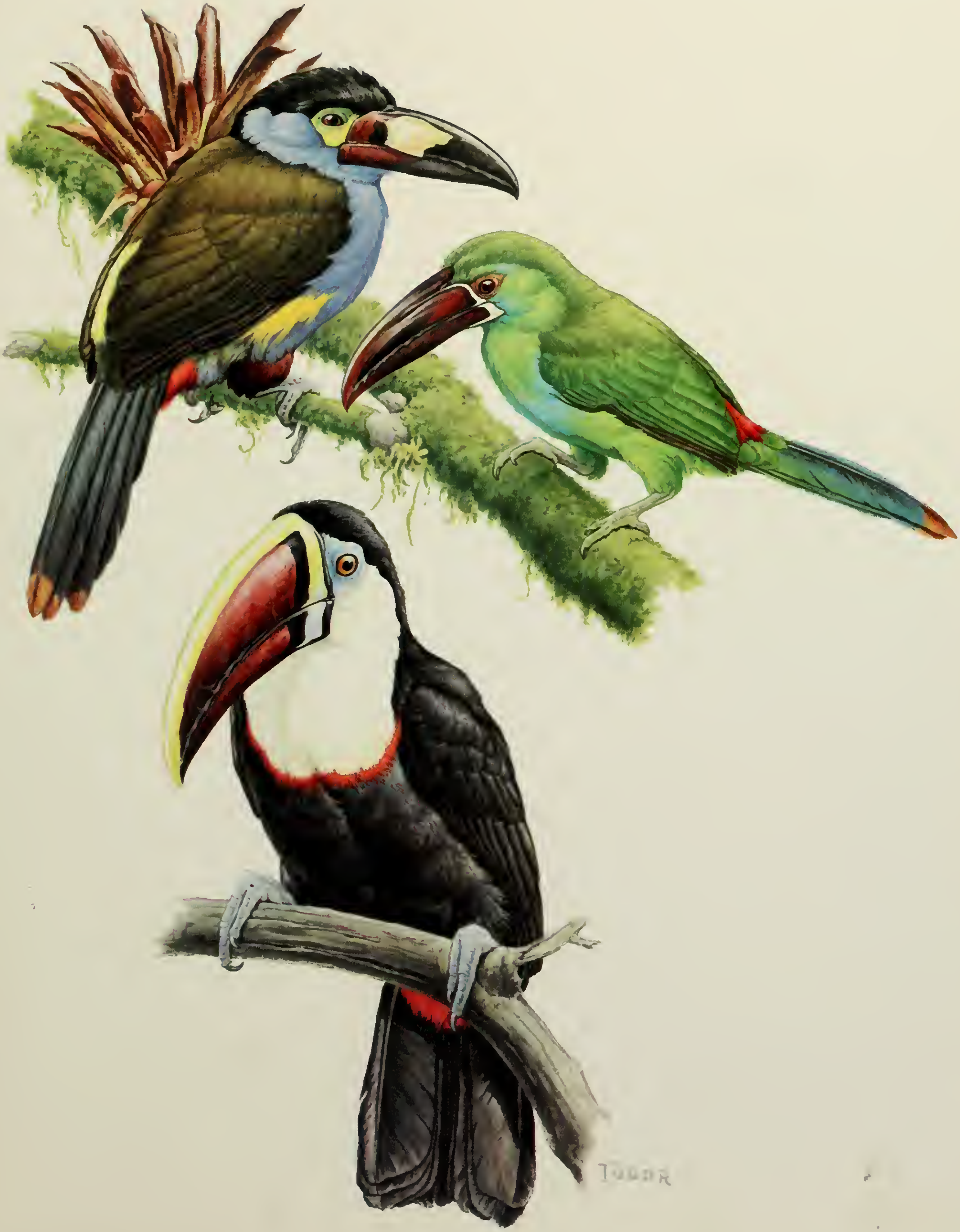
The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday. Obtain pass at reception desk, main floor.

Museum Telephone: 922-9410.

Tutankhamun Information: 922-5910

July/August
1977

Field Museum of Natural History Bulletin



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CONTENTS

3 **Field Briefs**

4 **Exotic Fliers: Portraits of Neotropical Birds**
New exhibit of bird paintings

6 **Guests of Summer:**
Garrulous tree-climbers who change color
by Floyd Swink

7 **Living Jewels of the Tropics**
by David M. Walsten
Photos courtesy of Kenneth T. Nemuras

10 **Treasures of the Des Plaines**
by Philip Hanson, senior program developer, Department of Education

18 **Our Environment**

back cover **July and August at Field Museum**
Calendar of coming events

The editor gratefully acknowledges the editorial assistance of Hermann C. Bowersox, a Field Museum volunteer, in the preparation of this issue.

COVER

Two toucans and a toucanet of South America. Painting by Guy Tudor. The original painting, of which this is a detail, is on view in Hall K with other bird paintings beginning July 12. For more on the paintings see page 4. The birds shown here are a plate-billed mountain-toucan, *Andigena laminirostris*, of Ecuador (upper left); a crimson-rumped toucanet, *Aulacorhynchus haematopygus*, of Colombia (upper right); and a red-billed toucan, *Ramphastos tucanus*, of Guyana (bottom). The painting was commissioned for *Manual of Tropical Birds*, by Field Museum emeritus curator Emmet R. Blake, and will appear in Volume II of this four-volume work. Volume I was recently published by the University of Chicago Press. *Copyright © 1977 The University of Chicago.*

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Field Briefs

Museum Receives Five Grants

Five grants totaling $169,150 have been awarded to Field Museum for a wide range of new and continuing programs of research, education, and preservation.

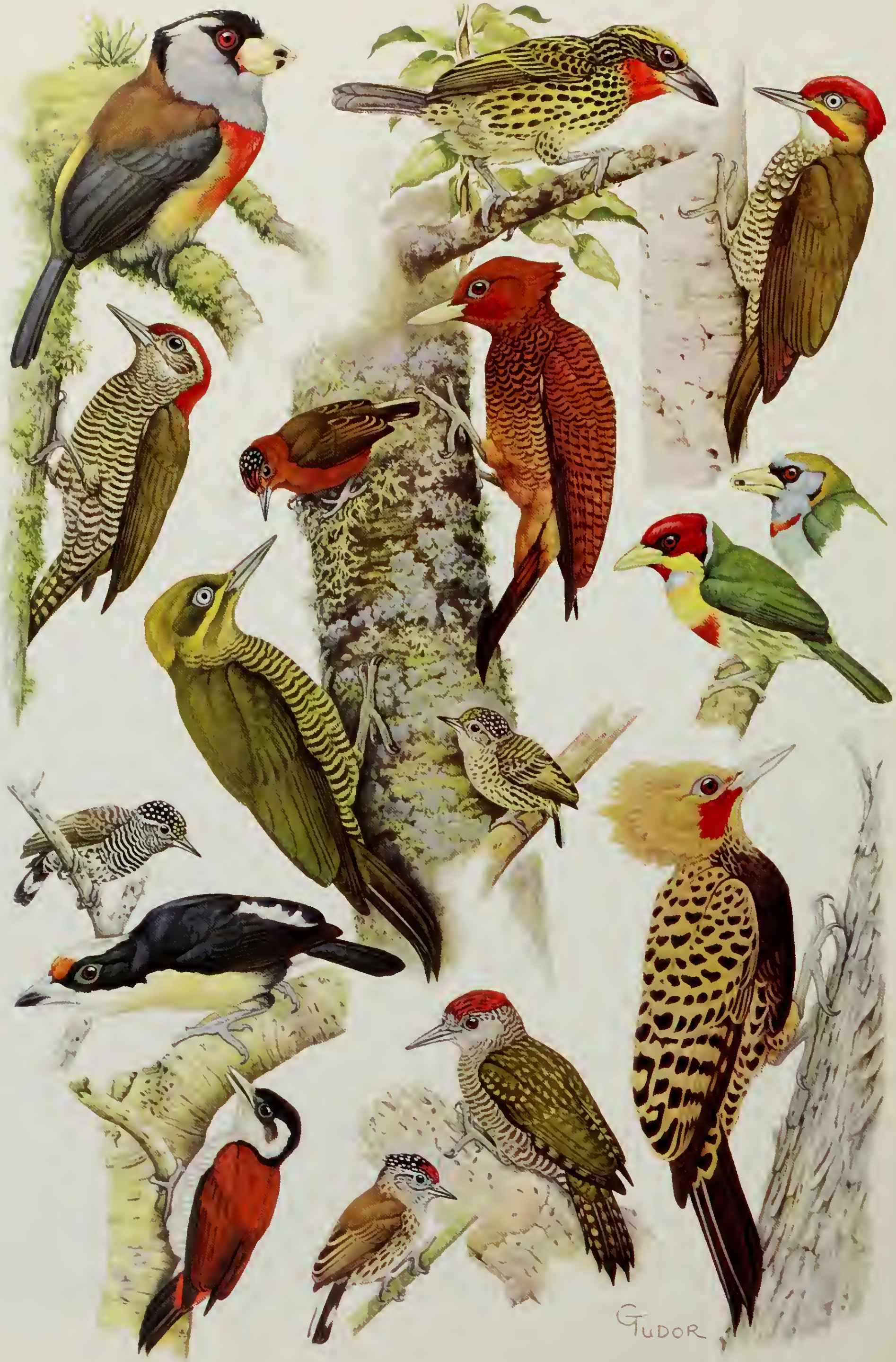
Continued support from the National Science Foundation (NSF) in the amount of $114,200 has been received for the investigation of Prehispanic irrigation in South America. Archaeological excavations on the desert coast of Peru have revealed irrigation systems (dating from 500 B.C. to A.D. 1400) demonstrably more productive than modern counterparts. Mapping and excavation of ancient canals supports the hypothesis that native engineers developed the principles of fluid dynamics and the technical hydraulic skills needed to optimize canal delivery systems some six or seven centuries before Western technology made the same discovery. Project director is Michael E. Moseley, associate curator of Middle and South American archaeology and ethnology.

NSF provides $15,700 in continuing support of a five-year renovation of the

(Continued on p. 14)

Future scientist examines specimens in Field Museum's exciting new "hands on" gallery, the Room for Wonder.

Ron Testa



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Exotic Fliers: Portraits of Neotropical Birds

"Exotic Fliers: Portraits of Neotropical Birds" is a new exhibit of original bird paintings, opening July 12 in Hall K. Featured in the exhibit is the work of Guy Tudor (whose paintings appear on the facing page and this month's cover) and of Richard V. Keane. Tudor and Keane are the principal illustrators for *Manual of Tropical Birds*, Volume I, by Emmet R. Blake, published July 1.* All of the paintings in the exhibit were prepared for the *Manual.*

Guy Tudor is a free-lance, self-taught artist who specializes in paintings of birds. A native of New York City, he has made numerous field trips to study birds in Central and South America and his paintings have appeared in Time-Life Books, *Encyclopaedia Britannica, Reader's Digest, Scientific American, Natural History*, the *Wilson Bulletin* (an ornithology journal), and other periodicals. He has also illustrated a number of field guides.

Richard V. Keane, a native Chicagoan, has been on the faculty of the Art Institute of Chicago since 1955 and received both his bachelor's and master's degrees from the Art Institute. As a boy, he visited Field Museum, "an inexhaustible treasure," to sketch specimens and he continues to bring his drawing classes there. He has sketched and painted birds in their natural habitats in Europe, Asia, Africa, the West Indies, and Mexico; and his work has appeared, notably, in publications of Encyclopaedia Britannica, Inc., and in various books on wildlife.

The author of *Manual of Neotropical Birds*, Emmet R. Blake, is curator emeritus at Field Museum and a scientist whose career has combined to an unusual degree laboratory research, field studies, and adventure. Although widely known as an ornithologist, he has also been a professional boxer, swimming instructor, World War II counter-espionage agent, and writer.

Born in South Carolina, Blake attended Presbyterian College, Clinton, S.C., graduated at 19, and was in graduate school at the University of Pittsburgh when he interrupted his studies to go on a year-long expedition for the National Geographic Society up the Amazon and into the jungles and mountains of the Brazil-Venezuela boundary. A few months after his return, he received an offer to conduct a collecting expedition to Venezuela from Field Museum. Blake succeeded in reaching the 9,000-foot summit of Mount Turumiquire and in only 35 days collected 803 birds, 96 reptiles, and 37 mammals—perhaps a record performance for one man. In 1935 he joined the scientific staff of Field Museum as assistant in the Division of Birds and in the following years rose to be curator in charge. He has participated in eight major collecting trips, mainly in tropical America.

"But expeditions are only a part of museum work," says Blake. "On returning from any expedition, specimens, often in the thousands, must be identified and catalogued, the new forms described and named, and the entire collection studied critically as steps in the preparation of the final technical report." Such reports document our knowledge of nature and are the basis of publications for the laymen. Blake has written numerous articles and books, technical and popular, based on his field work and research. His 650-page *Birds of Mexico, A Guide for Field Identification* (University of Chicago Press, 1953), now in its seventh printing, is recognized as an authoritative work on the avifauna of that country. ☐

◄ *Barbets (family Capitonidae) and woodpeckers (family Picidae) of Central and South America. Painting by Guy Tudor. This illustration is to appear in Volume II of the four-volume* Manual of Neotropical Birds, *by Emmet R. Blake. Volume I was recently published by the University of Chicago Press. The original painting, about twice the size of this plate, will be on view in the new exhibit "Exotic Fliers: Portraits of Neotropical Birds," opening July 12.*

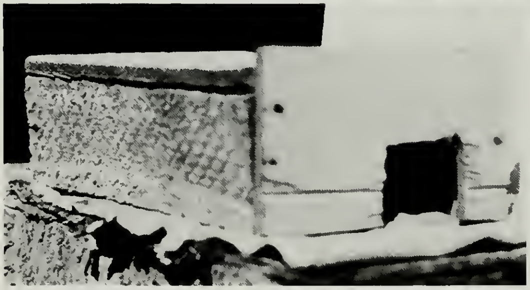
Emmet R. Blake, emeritus curator of birds, in his laboratory

**Manual of Tropical Birds*, Vol. I, by Emmet R. Blake; published by the University of Chicago Press; 704 pp., $50.00. Volume I (the first of four projected volumes) covers the families Spheniscidae (penguins) to Laridae (gulls and allies).

Guests of Summer: Garrulous Tree-Climbers Who Change Color

By Floyd Swink

Photos by Marie Swink



Floyd Swink is taxonomist at Morton Arboretum, Lisle, Ill.

Summer guests of Theodore Johnson, a resident of northern Wisconsin's Sawyer County, use his spare "cottage" only during the day. Around dusk they leave the cottage, climb into aspen or birch trees nearby and don't return until dawn. This remarkable routine continues from about June 1 to early September, with the first hint of freezing temperatures. The guests then vanish and Johnson doesn't hear from them again for about nine months. While at Johnson's, however, he hears from them every night as they vocalize in the woods.

Johnson's fair-weather friends are tree frogs *(Hyla versicolor)*, and the guest cottage, located on Johnson's porch, is 6 inches long, 2½ inches wide, and 1½ inches high. The cottage doorway is 1 inch square.

As their Latin name *(versicolor* = "color-changing") suggests, these frogs are often able to blend in with their surroundings by changing color, chameleon-fashion, from light green to gray. How are these guests able to locate the cottage each spring? "I haven't the froggiest," says Johnson. □

Living Jewels of the Tropics

Phyllomedusa tomoptera, a hylid, or tree frog, of Ecuador. Photo by George Pisani.

by David M. Walsten

Photos and resource materials courtesy of Kenneth T. Nemuras

Brilliant colors are characteristic of many frog species of the American tropics; but the dendrobatids, or poison-arrow frogs, are the most spectacular, as suggested by the color photos on pages 8 and 9. They are also notorious—as their common name suggests—for their highly toxic skin secretions, long used by Indians on the tips of arrows, darts, spears, and other flesh-piercing weapons.

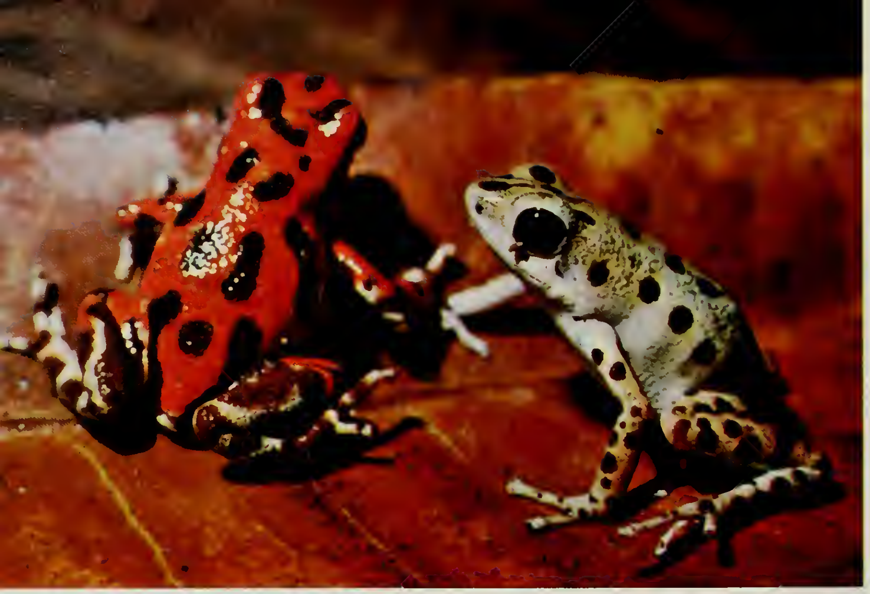
The Indians obtain the poison, a neurotoxin, by holding the dead frog above a fire, thus causing the skin to "sweat" droplets of the poisonous fluid. Birds or small mammals shot with a poison-dipped missile are paralyzed almost immediately; such a wound would ordinarily have little effect on a human or large animal.

The dendrobatids, of which there are some 70 species, are rather small, slender frogs distinguished by two scutes, or plates, on the dorsal side of each finger and toe. They are also unusual for the manner in which they care for their young. As soon as they are laid, the eggs are attached to the male's back. After hatching, the young tadpoles—which may number from 2 to about 20—remain on the parent's back for a period of several weeks. When they are sufficiently developed to fend for themselves, the father enters the water; the young are dislodged and on their own.

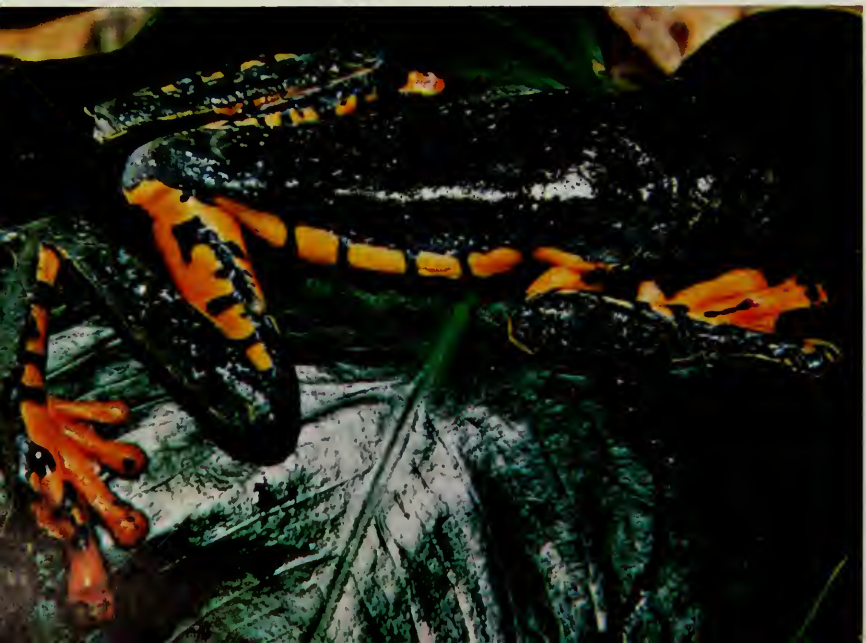
Some dendrobatids also exhibit interesting territorial behavior. Males of the Panamanian dendrobatid *Colostethus inguinalis* maintain territories along rocky river shores. If approached by another male, the territory "owner" stands up and shouts his territorial claim. If this fails to discourage the intruder the owner butts him with his head. Males of *Dendrobates pumilio*, also of Central America, will wrestle with one another, standing on their hind legs.

Other living "jewels" of the tropical Americas are to be found among frogs of the families Atelopodidae and Hylidae, also pictured on pages 8 and 9. The Atelopodidae, numbering about three dozen species, are also confined to the tropical Americas. Many of them do not hop in the manner of "conventional" frogs, but walk—and rather slowly at that.

The Hylidae, or tree frogs, include several hundred species and occur worldwide; they are most prevalent, however, in South America. An example of this group is shown above. The tree frogs are sometimes called the acrobatic clowns of the amphibian world. The barking tree frog, *Hyla gratiosa*, can perform on a miniature trapeze. This special ability is due to the presence of large suction discs on the tips of the fingers and toes. The grip is so firm that the frog can hang by the suction of a single disc. The jewelry of the tree frogs is their eyes, which may be ruby red, jade green, opalescent, golden, or virtually any other color of the rainbow. □



Living Jewels of the Tropics: (Top row, l. to r.) Dendrobates pumilio, *family Dendrobatidae; photo by Ken Nemuras.* Dendrobates auratus, *Dendrobatidae; photo by R. Wayne Van Devender.* Agalychnis callidrys, *Hylidae; photo by R. Wayne Van Devender. (Middle row, l. to r.)* Atelopus varius, *Atelopodidae; photo by Joseph T. Collins.* Dendrobates histrionicus, *Dendrobatidae; photo by Joseph T. Collins. (Bottom row, l. to r.)* Agalychnis calcarifer, *Hylidae; photo by Robert S. Simmons.* Dendrobates granulifera, *Dendrobatidae; photo by Joseph T. Collins.* Atelopus varius, *Atelopodidae; photo by Joseph T. Collins. Photos courtesy Ken Nemuras.*



Treasures of the Des Plaines

by Philip Hanson

Dolomite outcropping along valley of Des Plaines River, near Lemont, Illinois. Photo taken in 1890s.

Parts of this valley, in Chicago's 'backyard,' retain botanical gems of centuries past

For much of its 100-mile length, the Des Plaines Valley of northeastern Illinois is like countless other broad, flatbottomed valleys of the Midwest. But this tributary of the Illinois River, originating near the Wisconsin border, has a section between the town of Willow Springs (five miles southwest of Chicago's Midway Airport) and the city of Joliet that is remarkable for the communities of native prairie plants scattered along its valley floor. Among these plants are species that exist nowhere else or few other places in the world. Why do they grow here in this brief strip of valley? What is unique about this section of the Des Plaines?

The answer to these questions is basically one of geology. The 20-mile valley segment is enclosed by abrupt, sometimes vertical bluffs, exposing the pale dolomite* bedrock. The 70-foot deep, mile-wide valley is not the handiwork of the present stream—which is sluggish and indolent for most of the year; it was fashioned instead by torrential waters from glaciers of the last ice age as they warmed and melted.

The glaciers also left behind mounds of debris—boul-

Philip Hanson is senior program developer, Department of Education.

*Dolomite is calcium magnesium carbonate, a type of limestone ders, gravel, and pulverized rock that were imbedded in the ice. The mounds, or *moraines*, were deposited parallel to the ice front, and effectively dammed back the waters flowing from the glacier. One of these morainal dams was breached in two places, the resultant torrents carving out the Des Plaines Valley and its principal branch, the Sag Valley (the location of the present Calumet Sag Channel), which two valleys join about two miles downstream from Willow Springs.

For several millennia the volume of glacial meltwaters that charged down the Sag and Des Plaines was immense—comparable to that flowing today through the St. Clair River, which connects Lakes Huron and Erie. By 10,000 years ago, however, the water flow had much abated, and the main features of the present Des Plaines Valley were already well defined.

The events that created the valley also set up a variety of habitat conditions, each favoring the development of a particular plant and animal community. For example, the dolomite bedrock was exposed in many places where the glacial debris, or *till*, had been washed away, thus creating a harsh environment that could appeal to only a limited number of hardy, specialized plants. Elsewhere, parallel to the river bank, were low gravel ridges, deposited by the current during higher water conditions. Drainage from such relatively level surface is poor; thus, much of the floodplain within the valley is wet for long periods—a condition that is augmented by flowage from seep springs below the bluffs. In contrast, gravelly ridges above the mean water level stay relatively dry, for their coarseness favors rapid water loss through drainage and evaporation.

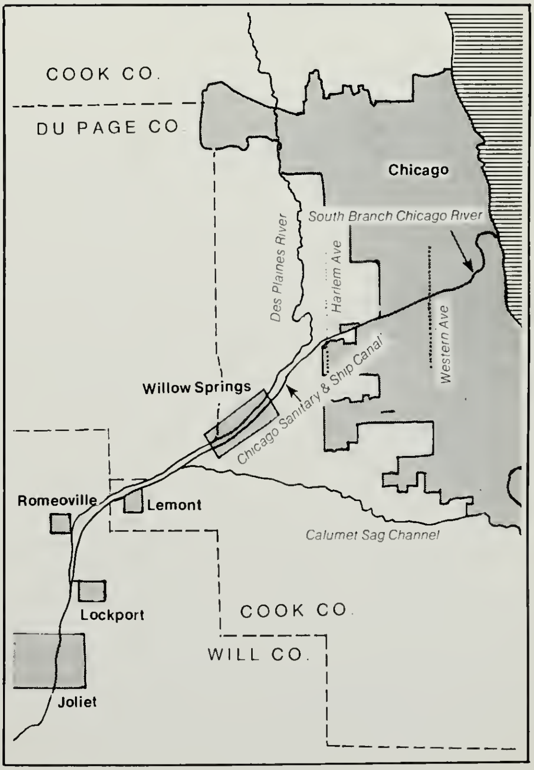
Marshes and wet prairie, which provide their own unique habitats, occur in the low spots in the valley's floodplain, such as pockets in the bedrock, and along the river edge. Here are to be found the plants and animals that cannot withstand the periodic dryness of other sections. Much of the valley floor, then, is a grassland community, primarily prairie, interspersed with marsh and fen.

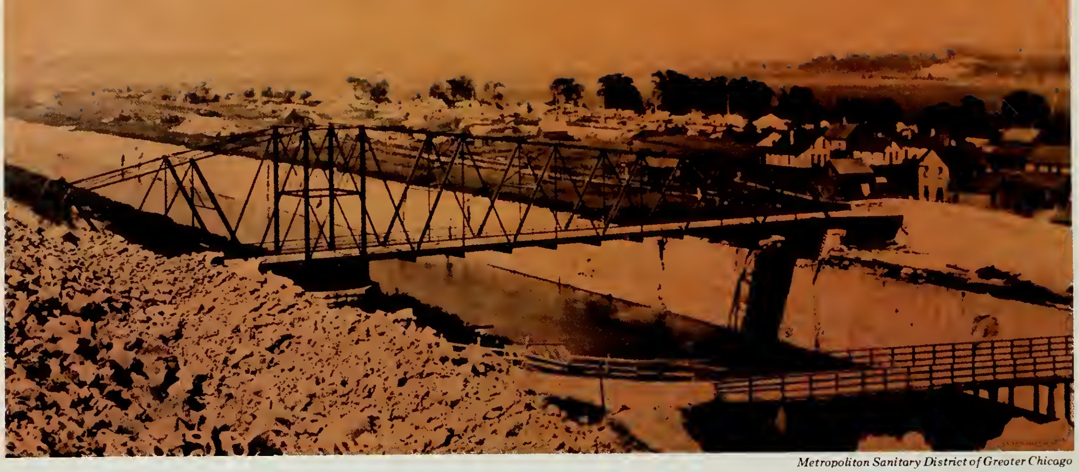
The periodic incursion of prairie fires, blowing in from the west, prevented the development of woodland communities on the west bank of the Des Plaines. But on the east bank, insulated by the river from prairie fires, there were numerous oak groves. Many fine old oak trees can still be seen in the area of Lockport and Lemont (about two miles and ten miles upstream from Joliet, respectively). On the west side, however, the sparse trees are mainly those planted as windbreaks or for shade.

At frequent intervals there is a transition from one type of prairie to another. Dry prairie merges to *mesic*, or moderately moist, prairie, then to wet prairie. Little bluestem grass (*Andropogon scoparius*), and side oats grama grass (*Bouteloua cortipendula*) are the most common plants in the dry areas. Moister areas have a greater abundance of big bluestem grass (*Andropogon gerardi*). Prairie cordgrass (*Spartina pectinata*) marks the beginning of wet prairie, while blue joint grass (*Calamogrostis canadensis*), sedges, and the uncommon tufted hair grass (*Deschampsia caespitosa*) are predominant in the wet prairie. Because of the unusual geology of the area, the driest prairie plants are sometimes to be found growing next to large tracts of cattail (*Typha latifolia*), a marsh-dweller.

The calcareous nature of the area is indicated by the presence of *calciphiles*, or calcium-loving plants, such as purple angelica (*Angelica atropurpurea*), prairie alum root (*Heuchera richardsonii*), swamp betony (*Pedicularis lanceolata*), and the aromatic low calamint (*Satureja arkansana*).

The variety of grassland habitats together with the large expanses of marsh and fen also support a diversity of animal life. A great variety of migratory waterfowl, in fact, must once have prevailed in the Des Plaines Valley, along the Sag Valley, and in the Calumet area (immediately south of Chicago). Collectively, these areas pro-





Metropolitan Sanitary District of Greater Chicago

The Chicago Sanitary and Ship Canal near Romeoville (then Romeo) in 1899, shortly before completion.

vided some 25 square miles of prime wetland habitat, important to early settlers as a source of game.

An old history of Will County, where much of the 20-mile segment of valley is located, gives an idea of the variety of birds that once lived in this valley: An early settler

> remembers two species of birds quite common here when his father removed to this section, in 1834, but which have long since disappeared. One of them was about the size and very similar to the English curlew. It had a bill about seven or eight inches long, and when disturbed would rise in the air, and circling overhead, pronounce very distinctly the word *chelee*. The other was somewhat smaller in size, but similar in appearance, and could say very plainly "go to work." But as soon as the English and Irish came in, who are fond of birds as food, and took to shooting them, they soon disappeared.[1]

The first bird described above was very likely the long-billed curlew (*Numenius americana*), a species no longer seen in this area but found along the Texas coast and western grasslands. The second bird is probably the Eskimo curlew (*Numenius borealis*), now close to extinction.

A visitor to the town of Lockport in 1850 describes a hunt that took place in the valley directly west of the town:

> This afternoon we spent in snipe shooting, in the bottoms immediately below the town, and in the space of three hours we brought home forty couple of these birds, in addition to many ducks and teal.[2]

*Tennessee milk vetch (*Astragalus tennesseensis*), a calciphilic plant that may still occur in the Des Plaines Valley, although it has not been seen there for years. Last year Robert Betz, a Field Museum research associate, discovered the plant in a similar habitat in central Illinois.*

Marlin Bowles, Illinois Department of Conservation

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[1] *History of Will County, Illinois* (1878), by George H. Woodruff, W. H. Perrin, and H. H. Hill

[2] *A Glimpse of the Great Western Republic* (1852), by A. A. T. Cunyngham.

John Kolar

*Clumps of tufted hair grass (*Deschampsia caespitosa*), an uncommon species found in wet prairies of the Des Plaines Valley.*

At the point where the Des Plaines River approaches the southwest edge of Chicago, it was once connected to a long marsh known as Mud Lake, which lay in the area now traversed by the Stevenson Expressway between Harlem and Western Avenues. At the east end of the marsh was a low continental divide. Rain falling east of the divide entered the Great Lakes basin, flowing eventually into the Atlantic Ocean. Rain falling west of the divide flowed into the Des Plaines, down the Illinois, then the Mississippi, and finally into the Gulf of Mexico. By taking a short portage across this divide and through Mud Lake, a small boat had easy access from much of northeastern North America to the Gulf of Mexico. The Des Plaines River Valley, though minuscule on the face of the continent, thus provided a vital, natural corridor for travel and commerce. This same portage had been used for centuries by Indians, and the river was an important trade route between the midwestern prairie tribes and those of the northeastern woodlands.

Not surprisingly, there were many campsites in the Des Plaines Valley. Some were on islands; others were along the bluffs, where seep springs provided fresh water. The earliest European explorers learned of the portage and the valley route from the Indians. Thus, Jolliet and Marquette first used it in the 1670s, followed by countless other European and American explorers and traders. Many paused to camp in the valley itself. In 1698, Jean St. Cosme, a French missionary, camped on an island called Isle a la Cache, today the site of the town of Romeoville, about seven miles upstream from Joliet.

Jolliet, in 1673, was the first to note that a canal cut through the divide would eliminate the need for a portage. By connecting the Chicago with the Des Plaines River, he pointed out, water traffic could flow easily from the Great Lakes to the Gulf of Mexico. The notion of a canal through the Des Plaines Valley was to be brought up again and again, including a proposal by Albert Gallatin, Thomas Jefferson's secretary of the treasury, in 1805.

Finally, in 1836, construction of the Illinois and Michigan Canal was begun. In 1848 the 100-mile canal (long enough to bypass the shallow rapids north of Joliet and those further south at the town of Ottawa) was opened for traffic. Until about 1914 freight and passengers were to pass down the valley of the Des Plaines, but with the proliferation of railroad lines—which offered speedier transportation—the canal became obsolete.

A second major construction project, in the 1890s, would permanently alter the face of the Des Plaines Valley and even change the course of the river itself. The growing city of Chicago, which got its drinking water from Lake Michigan, was beginning to pollute that supply with sewage. To solve this difficulty, it was proposed that a new channel follow the route of the Illinois and Michigan canal completed a half century earlier. The purpose of the new channel would be to drain the sewage away from Lake Michigan and the city by reversing the flow of the Chicago River. By 1900 the Chicago Sanitary

(Continued on p. 16)

FIELD BRIEFS *con't from p. 3*

museum's extensive mammal collection. Part of the grant will be used to purchase moveable cases permitting better utilization of storage space for the 120,000 specimens. The collection, one of the top five in the United States, is particularly noted for its holdings of South American mammals. The project is under the supervision of Rupert L. Wenzel, chairman of the Department of Zoology.

An NSF grant of $9,500 supports the twelfth year of a summer anthropology course for high-ability high school students. The course, an introduction to the scientific study of man, offers an unusual opportunity for secondary school students to learn the variety and scope of anthropological research. One-fourth of the course is devoted to archaeological excavation and laboratory analyses that contribute to a continuing program in local prehistory. Extensive use is made of Field Museum's exhibits and specimens from its famous anthropological collections. The course is directed by Harriet M. Smith, Department of Education.

A grant of $18,500 from the National Endowment for the Arts will be used for an inventory control project of 300,000 anthropological artifacts being moved into the museum's new storage-study facilities. During the move, inventory control will be carried out by means of a computerized file of the anthropology catalog. Project director is Phillip Lewis, chairman of the Department of Anthropology and curator of primitive art and Melanesian anthropology.

The Illinois Department of Conservation, under its Historic Preservation Program, has granted the Museum $11,250 to study ways of cleaning, restoring, and preserving the Museum's exterior.

Bolt Appointed Associate Curator

John R. Bolt, who joined Field Museum's Department of Geology in 1972, has been promoted to associate curator of fossil reptiles and amphibians. Dr. Bolt's research has dealt mainly with the morphology and evolution of early land vertebrates. Currently he is studying the functional evolution of the middle ear of frogs and of the evolution of dentition in early reptiles.

New Visitor Guide

A completely revised, 52-page *Guide to Field Museum of Natural History* is now available at the Field Museum shops for 50c. The *Guide* contains detailed floor plans, general information about the museum, its history, exhibits, educational programs, and volunteer activities, and a separate section on each of the four curatorial areas: anthropology, botany, geology, and zoology.

The completely revised and updated *Guide* was written by Nika Semkoff Levi-Setti, public relations assistant, and designed by Marjorie Korobkin.

Identification for "Tut" Admission

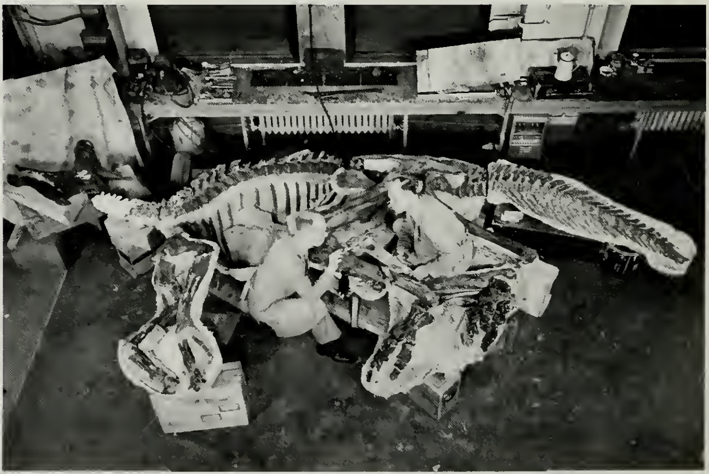
Field Museum members and their immediate family are entitled to priority admission to the "Treasures of Tutankhamun" exhibit, on view at the Museum until August 15. However, additional identification, such as a driver's license, is required of members when obtaining an exhibit admission ticket at the "Tut Central" desk in Stanley Field Hall.

Gilpin Retires

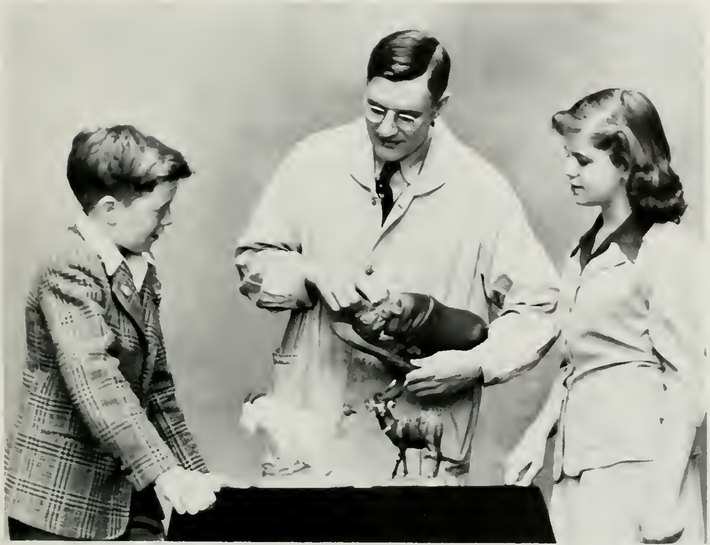
Orville "Gilly" Gilpin, chief preparator of fossils, has recently retired after 39 years of service to Field Museum. Gilpin worked on hundreds of fossil-building projects involving almost every known type of fossil vertebrate. He also participated in numerous geological field trips over the years. He will probably be best remembered, however, for his restoration work with dinosaurs and fossil reptiles.

Gilpin's best known work is perhaps the two dinosaur skeletons reconstructed in Stanley Field Hall: the erect *Gorgosaurus* and the slain *Lambeosaurus* lying at its feet. When it was completed in 1956, the *Gorgosaurus* reconstruction became the world's first self-supporting dinosaur skeleton. (Its iron supports are within the bones.)

Gilpin considers the *Edaphasaurus* skeleton in hall 38 his greatest challenge. "The restoration went well," he says. "The challenge of this project was the actual mounting." Iron bars had to be inserted through the reptile's backbones, and each bone on the spine had to be drilled and fitted with a piece of iron. Gilpin describes the project as one of trial and error. If an iron rod didn't fit, it had to be pulled out and tried again, like a three-dimensional jigsaw puzzle.



Preparator Orville Gilpin (rt.) and Curator William D. Turnbull put finishing touches on fossil skeleton of Lambeosaurus, *now on view in Stanley Field Hall. 1955 photo.*



John R. Millar in 1945, when he was on the staff of the Museum's Harris Public School Extension.

October Members' Nights Postponed

Field Museum's traditional Members' Nights, which had been scheduled for October 6 and 7, have been postponed to spring, 1978. The postponement is deemed necessary because many of the areas in the curatorial departments will be in the midst of renovation, making the accommodation of large numbers of visitors difficult or impossible. However, by spring, 1978, enough of the renovation work will be completed so that the customarily large Members' Night crowds can be easily accommodated.

John R. Millar
Retired Deputy Director

John R. Millar, who served Field Museum for half a century, died in Chicago May 8, at the age of 78. He had been living for several years in Florida and was visiting in Chicago at the time of his death.

He joined the Museum in 1918 as a boy just out of high school and retired in 1968. During his career, Millar held the positions of preparator, Department of Botany; curator of the Harris Public School Extension (an educational division of the Museum); chief curator of the Department of Botany; chairman, Department of Exhibition; and deputy director of the Museum.

In his position as preparator in the botany department he took part in a number of collecting expeditions including the Southern Florida Expedition of 1918-19; the 1922 Stanley Field Expedition to then British Guiana; the 1926 Captain Marshall Field Brazilian Expedition; and the 1938 Sewell Avery Expedition to Nova Scotia, of which he was the leader.

Almost as soon as he joined the Museum Millar became involved in its move from the original structure in Jackson Park to the present Museum building at Roosevelt Road and Lake Shore Drive. He directed several moving gangs and "accomplished the job easily and comfortably by using roller skates."

E. Leland Webber, president of Field Museum, observed that "Millar was among the leading staff members in the Museum's history, since he carried major responsibilities in more areas of the Museum than any other person before or since."

Ralph Gordon Johnson,
Research Associate

The recent death of Ralph Johnson was a profound loss to the scientific community at large and in particular to the Field Museum, where he had been a research associate since 1962. He was also professor of paleontology and chairman of the Department of Geophysical Sciences at the University of Chicago. Johnson's work with Eugene S. Richardson, curator of fossil invertebrates at Field Museum, was concerned with the coal age fossils of Mazon Creek, in Grundy County, Illinois.

Johnson was one of the prime motivating forces in Mazon Creek studies since he first teamed up with Richardson. That collaboration, begun in 1966, produced the now classic paper which first formally delineated the differences between the Essex and Braidwood faunas of the Mazon Creek area.

His associations with Field Museum reflect a life-long interest in natural history. Born in Oak Park, Illinois, in 1927, some of his early contacts with wildlife came from association with Henry Dybas, Field Museum's curator of insects. A childhood interest in reptiles culminated in a Ph.D. thesis, in 1954, on venomous snakes, at the University of Chicago, under the direction of the Museum's famed herpetologist Karl P. Schmidt.

Johnson's professional association with the University of Chicago began in the early fifties, when he was asked to temporarily teach invertebrate paleontology; he stayed on for the rest of his life. His interest in invertebrate biology began in 1955, when he spent a summer at the Pacific Marine Station in California. Ever mindful of the dictum "the present is the key to the past," Johnson constantly strove to relate his findings in living biological communities to fossil ones. He became a contributor to one of the first compendiums on paleoecology, and is acknowledged as a pioneer in this field. Later he worked with the Marine Biological Laboratory in Woods Hole, Mass. Johnson was editor of the journal *Evolution* from 1966 to 1970 and a cofounder and an editor of *Paleobiology*. He was also a trustee of the Shedd Aquarium.

—*Frederick R. Schramm*

Lakeside daisy
(Actinea herbacea)

John Kolar

Des Plaines *con't from p. 13*

and Ship Canal was completed. Its course was cut deep into the bedrock of the valley, and piles of excavated earth and rock 70 feet high paralleled the new waterway down the center of the valley. In the 1930s the new channel was lengthened and otherwise improved to accommodate barge traffic.

The ready availability of rail and water transportation attracted industry to the valley. Oil refineries, electric generating plants, and quarrying and gravel operations soon turned the valley from a carpet of prairie and marsh to a mosaic of natural areas interspersed with industry.

Despite the coming of industry to the valley in recent decades, much of the remaining land has remained as it was in the time of Louis Jolliet. While most of the deep-soil prairies in Illinois were quickly converted into farmland, the shallow-soil, boulder-strewn bottomlands of the Des Plaines Valley were spared. The valley was also subject to flooding as well as drought, making crop farming there a risky or impractical enterprise. The most common agricultural use was as pastureland.

What has now created fresh interest in this segment of the Des Plaines Valley is the discovery there of plants once thought to be extinct in Illinois. Among these is the leafy prairie clover (*Petalostemum foliosum*) which, until 1974, had not been seen in the state for more than 70 years. In the past three years, however, it has been discovered in three separate locations in the Des Plaines Valley—all tiny colonies within four miles of one another. Another recent find in the valley is prairie satin grass (*Muhlenbergia cuspidata*), unique to dry calcareous prairie soils. The discovery of these two species means more than just restoring two plant names to a list of Illinois flora; it means that the type of habitat capable of supporting these two specialized prairie plants has managed to retain its integrity during a century and a half of human settlement and disruption.

Research on the leafy prairie clover and satin grass suggests that they have adapted themselves to an unusual set of environmental conditions that the Des Plaines Valley can fulfill; but the exact reasons for survival here of these plants remain unclear. If we wish to speculate, however, a possible reason is that competition between plants in the shallow-soil valley may not be as great as on deep-soil prairies. Also, the high calcium concentration in the soil may inhibit the growth of nonadapted species, thus giving an advantage to those that are adapted.

The leafy prairie clover was formerly found in major river valleys in four northern Illinois counties. Today it is known to occur only in southern United States and in Illinois near Romeoville. In the Southeast it is found only in the limestone glades of central Tennessee and northern Alabama, where its habitats are gradually disappearing.

Prairie satin grass is usually found on the dry western prairies. Its rediscovery on the Des Plaines prairies in Will County is its first sighting in Illinois in 60 years. It is not known to occur anywhere further east.

Two rare, but possible residents of this same section of Des Plaines Valley prairie are the lakeside daisy (*Actinea herbacea*) and Tennessee milk vetch (*Astragalus tennesseensis*). The lakeside daisy has been found in only four limited regions of the world, one of them being the Des Plaines Valley south of Joliet. Botanists are thus optimistic about its also being present in the valley sector north of that city. The Tennessee milk vetch, also a calciphile and a close associate of the leafy prairie clover, was known to formerly occur in the Des Plaines Valley. It has recently been found in a similar habitat in western Illinois.

The ecological importance of the Des Plaines Valley is not just that of a refuge for a few rare wild plants. Its significance is that of a natural community that still has all of its dynamic characteristics intact, and thus is able to provide the proper environment for the rare plants mentioned here as well as for 150 other prairie species.

Though much open space remains in the Des Plaines Valley, not all of it contains prime natural areas. Exactly how much land falls into this category is to be determined by an Illinois Natural Areas Inventory (INAI) survey, the results of which will be made available to interested organizations. (For more on the INAI surveys, see June 1977 *Bulletin*, p. 18.)

Old quarries, now filled with water, support diverse populations of aquatic insects and other invertebrates. These provide excellent outdoor laboratories for studying the dynamics of aquatic ecosystems. Biology classes at Lewis University, of Lockport, have used the quarries in this way for several years.

Several groups are currently working to preserve various parts of the valley. Open Lands Project is coordinating efforts to obtain long-term preservation of the valley's prairie areas. Another group called Save the Valley is trying to preserve portions of the valley west of the town of Lemont. Where the valley passes through Cook and Du Page Counties, the forest preserve districts of these counties have acquired large tracts of land within and adjacent to the valley.☐

*Leafy prairie clover (*Petalostemum foliosum*)*

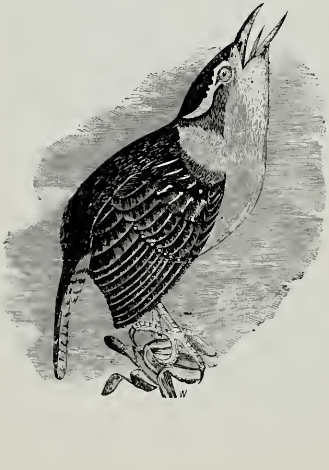
John Kolar

Our Environment

New Proposed Injurious Wildlife Regulations

The Interior Department's U.S. Fish and Wildlife Service has recently proposed wildlife importation regulations which would streamline and clarify the present regulations governing injurious wildlife. The proposal also would add a number of forms of fish and wildlife to the present list of injurious wildlife that may be imported only under permit issued by the Secretary of the Interior for scientific, educational, zoological, or medical purposes.

The Service proposes to add a number of additional high-risk species to the 1900 Lacey Act restrictions on wildlife imports without otherwise changing the concept of the present regulations. These new proposed regulations will result in increased protection to human beings, to the interest of agriculture, horticulture, forestry, wildlife, or to the wildlife resources of the United States. A number of venomous snakes, stingrays, piranhas, vampire bats, and the like are included on the new list.



The proposed regulations do not involve a complete ban or prohibition on the importation of any species. However, they attempt to ensure that creatures which pose a threat are imported only by responsible people for justifiable purposes. Economically, on a national basis, the overall effect of these proposed regulations is expected to be insignificant. If implemented as proposed, these regulations would affect those people who have previously imported species of wildlife on the so-called "dirty list" for purposes for which permits cannot be issued.

The proposal would add the following species to the existing list of injurious wildlife for the reasons assigned:

- *Vampire bats* feed only on fresh blood lapped from wounds inflicted on warm-blooded vertebrates including domestic mammals and man. They are carriers and transmitters of rabies.
- *Ferrets, stoats, and weasels* have been destructive to native wildlife where they have been introduced deliberately or accidentally.
- *Bulbuls* are gregarious birds that feed on fruit, berries, and insects. Two species are established in the United States, and other species could become established.
- *Starlings and mynahs* listed in the proposal are gregarious, aggressive, and omnivorous. Species of these birds have demonstrated an ease of colonization and have been introduced widely throughout the world. Four species are established in the United States and Canada.
- *The Japanese white-eye*—a small bird—is established in Hawaii, where it appears to compete with native species for food. It readily colonizes new habitats and would compete with many continental species if established.
- *The African clawed frog*, established in southern California, feeds on almost all other forms of aquatic animals, and not only competes with but preys on native amphibians.
- *The giant toad*, already established in the United States, competes with and preys on other wildlife species.

All the snakes listed, such as pit vipers and cobras, are venomous and can inflict serious, even fatal, bites on humans. Some species listed are frequently imported and may be sold to persons unaware of the danger involved. There are 50 species of fish included on the list. They are either parasitic, venomous, electric, large agressive predators, or superior competitors and would be detrimental if introduced into U.S. waters. There are presently no known safe and efficient means for control of these fish if they become established.

The Boundary Waters Canoe Area: A Wilderness Ecosystem in Need of Protection

The Boundary Waters Canoe Area (BWCA) in northeasternmost Minnesota is larger than all other designated wilderness areas in the eastern United States combined—yet it isn't totally protected. A special provision of the Wilderness Act stipulates that "...the management of the Boundary Waters Canoe Area ... shall be in accordance with regulations established by the Secretary of Agriculture with the general purpose of maintaining, without unnecessary restrictions on other uses, including that of timber, the primitive character of the area..."

This provision—with its double negative, "without unnecessary restrictions"—has been the basis for controversy since the Wilderness Act was passed in 1964. The U.S. Forest Service has interpreted the provision to mean that logging is permissible, and it has allowed timbering in large portions of the virgin forest along the southern part of the area. Conservationists, on the other hand, claim that the intent and spirit of the Wilderness Act requires that the virgin forest be protected and preserved to "maintain the primitive character" of the land.

The virgin forest ecosystem of the BWCA, with its associated lakes and wetlands, has developed over thousands of years in response to the climate, physical setting, and the interactions of wildlife and other ecosystem components including such natural disturbances as wildfire and windstorm.

More than a million acres in size, the BWCA contains vast acreages of virgin forest over half of its lands. The other half has been logged, beginning in the late 1800s and continuing through 1972.

This activity has left its mark. While much of the area of early logging has partially recovered by natural reforestation and in a few more decades will have at least a resemblance to virgin forest, timbering in the modern style, with rock-raking, herbiciding, pine-planting, and the construction of gravel roads, has left a more permanent scar.

The region is a popular recreational area because of the myriad of interconnecting lakes and streams, most of them accessible only by canoe. Visitor use has increased by about 10 percent per year since 1972, and restrictions are now necessary at the more popular entry points. Use also has extended into the back country away from waterways via foot trials. Thus, the present policy of preserving only the forest fringes visible from lakes and streams in nearly half of the area is an unsatisfactory compromise in the eyes of many conservationists.

Over a period of time the shifting mosaic of the virgin forests in the BWCA has created diverse and unique habitats suited to a wide variety of wildlife. The primeval forest was not a vast area of mature climax forest, but a composite of many successional stages following natural disturbances such as fire, windstorm, and insect infestation. Moose, beaver, and ruffed grouse favor areas of young growth of birch, aspen, and the other hardwoods that sprout after fires. Bear are also common in such regions, because of the prevalance of berries in open areas. All of these species shifted their populations from place to place, following fires, utilizing the early post-fire vegetational stages as feeding areas. In the mature forests of pine, spruce, and fir, woodland caribou were found in association with ground and tree lichens, although even these animals used the open areas of recently burned regions for certain habitat needs.

While the white-tailed deer was not common in the primeval forests of the BWCA (its range was primarily confined to the mixed hardwood forests of central Minnesota and the prairie border to the west and south), other species such as the pine marten, fisher, squirrel, spruce grouse, pileated woodpecker, and a variety of warblers were frequently found in patches of older forests. And the eastern timber wolf was a major predator throughout the region.

As man's encroachment continued into the BWCA in the 1890s, however, major changes in the natural patterns of vegetation and wildlife unsued. While logging opened up areas of browse and created a diversity of habitat, it in no way duplicated the processes of natural forces such as fire and windstorm. Proponents of wilderness protection argue that by permitting the burning of natural fires under carefully monitored conditions, equally diverse habitat areas can be created and the natural mix of wildlife found within the BWCA forest ecosystem maintained—all in keeping with the wilderness philosophy.

Attempts to preserve the remaining virgin forest in northeastern Minnesota and to restore some of the cutover land date back to the 1920s. The BWCA was incorporated into the National Wilderness Preservation System in 1964 with passage of the Wilderness Act, which designated for protection areas "where the earth and its community of life are untrammeled by man, where man himself is visitor who does not remain... retaining its primeval character... managed to preserve its natural conditions...where the imprint of man's work is substantially unnoticeable."

To many, however, it is questionable whether the Forest Service, by permitting logging and mechanized travel in portions of the BWCA, is upholding the philosophy upon which the Wilderness Act was created. They argue that the natural balance between physical factors, such as weather and fire, and biological factors, which involve the entire mosaic of vegetation types as well as the associated wildlife, must be restored if the BWCA is to remain a true wilderness system. As an alternative, they propose that the vast acreages of the Superior National Forest outside of the BWCA be managed for intensive game production, commercial logging, and motorized recreation.

Debate over management of the BWCA wilderness was brought to a head in 1972 when the Minnesota Public Interest Research Group (MPIRG) filed a lawsuit arguing that under the National Environmental Policy Act of 1970 (NEPA), an environmental impact statement was required before timbering activities could be continued in the BWCA. The case was successful and an impact statement was issued. A year later, MPIRG, joined by the Sierra Club, renewed the suit on two counts: first, that the statement was incomplete, and second, that the logging activities themselves were prohibited under the spirit of the Wilderness Act. The suit (MPIRG vs. Butz) was successful in the district court, and Judge Miles Lord halted logging in almost all of the virgin forest areas of the BWCA. The decision, however, was overruled by the 8th Circuit Court of Appeals last summer, and the timber cutting that had been enjoined for 3½ years again became possible. While commercial loggers have voluntarily agreed to delay cutting of virgin timber under an agreement established by Rep. James L. Oberstar (Minn.), the Supreme Court recently turned down a request to review the lower court decision; thus, logging is expected to resume once the six-month moratorium expires September 15.

With the ultimate resolution of this matter still uncertain, a legislative initiative has been taken up in Congress. Congressmen Oberstar and Donald M. Fraser, also of Minnesota, have introduced bills which address the issue of wilderness preservation. Under Rep. Oberstar's bill, a large portion of the virgin forest in the BWCA would remain in the wilderness system. The remaining 40 percent of the wilderness would be designated as a national recreation area, subject to timbering as well as mechanized recreation. In contrast, Rep. Fraser's bill offers . complete wilderness protection under the same standards that apply to other units of the federal wilderness system—*H.E. Wright, Jr., courtesy* Conservation News. *The author is a professor of geology and ecology at the University of Minnesota and sponsor of the Friends of the Boundary Waters Wilderness.*

July and August at Field Museum

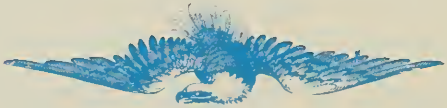
(July 15 through September 15)

Special Exhibits

Treasures of Tutankhamun — through August 15. This exhibit, on loan from the Egyptian government, features a dazzling display of 55 of the most beautiful and best-preserved objects from the tomb of the pharaoh who lived 3,300 years ago. Among these are the startling golden effigy of Tutankhamun, the graceful gilt statuette of the goddess Selket, a gilded figure of the young pharaoh harpooning, and a small gold shrine of exquisite craftsmanship. The exhibit also includes superb examples of Tutankhamun's funerary jewelry, furniture, writing materials, musical instruments, games, and decorative objects of alabaster and ivory. (Cosponsored by the Oriental Institute, University of Chicago.) Monday through Wednesday, 9 a.m. to 6 p.m.; Thursday through Sunday, 9 a.m. to 9 p.m. For information on Tutankhamun exhibit call 922-5910.

The Magic of Egyptian Art — through August 15. A supplementary exhibit at the Oriental Institute, 1155 East 58th Street, runs concurrently with the Tutankhamun exhibit at Field Museum. It features artifacts from the Oriental Institute's permanent collection, including objects used in the actual embalming of Tutankhamun and at his funerary banquet. Tuesday through Sunday, 10 a.m. to 4 p.m.; Sunday, 12 a.m. to 4 p.m.

Exotic Fliers: Portraits of Neotropical Birds. Opens July 12. An exhibit of exquisite bird paintings appearing in the recently published **Manual of Neotropical Birds** (University of Chicago Press), Vol. I, by Emmet R. Blake, emeritus curator of birds. Hall K, ground floor. (For more on these paintings see p. 4)



Continuing Exhibits

The Place for Wonder. This gallery provides a place to feel, try on, handle, sort, and compare natural history artifacts and specimens. The possibilities are endless — and so are the chances to ask questions and get answers. (Trained volunteers are on hand to help and guide in exploration.) Opens promptly: weekdays, 1 p.m. and 2 p.m.; weekends, 10 a.m., 11 a.m., 1 p.m., 2 p.m., and 3 p.m. Located near the new cafeteria, ground floor.

Man in His Environment. This exhibit takes a global view of some of the most serious environmental problems confronting all mankind and asks visitors to involve themselves in these problems — and the need for solution. Hall 18, main floor.

Male and Female: Anthropology Game. This fascinating game/exhibit of 39 artifacts lets you play anthropologist. Look at the artifacts and decide whether they were used by men or women. Discover that economic and social roles of men and women are not universally the same. Game scorecards are available. Elevator lobby, ground floor.

Continuing Programs

Audio Information System. The museum's newly installed audio system, Uniguide, enables visitors of all ages to visit up to 50 selected exhibits in any sequence they choose. Complete with background music, sound effects, and factual information supplied by the museum's scientific and education staff, this system provides an entertaining as well as educational experience. Specially designed audio receivers and maps are available for a nominal fee at the entrance to the Museum Shop, main floor.

Summer Journey for Children: Spelunking — through August 31. Self-guided tour for children (with or without parents) leads them to exhibits that exemplify the geology and biology of caves. The *Journey* poses numerous questions about caves. Among them are: In what type of rock are caves found? How do cave environments differ from others? What animals live in caves? *Journey* sheets are available at the information booth, main floor.

Weekend Discovery Programs. Saturdays and Sundays, 10 a.m. to 3 p.m.: take tours, follow demonstrations, participate in museum-related activities.

Museum Hours Now Through August 15

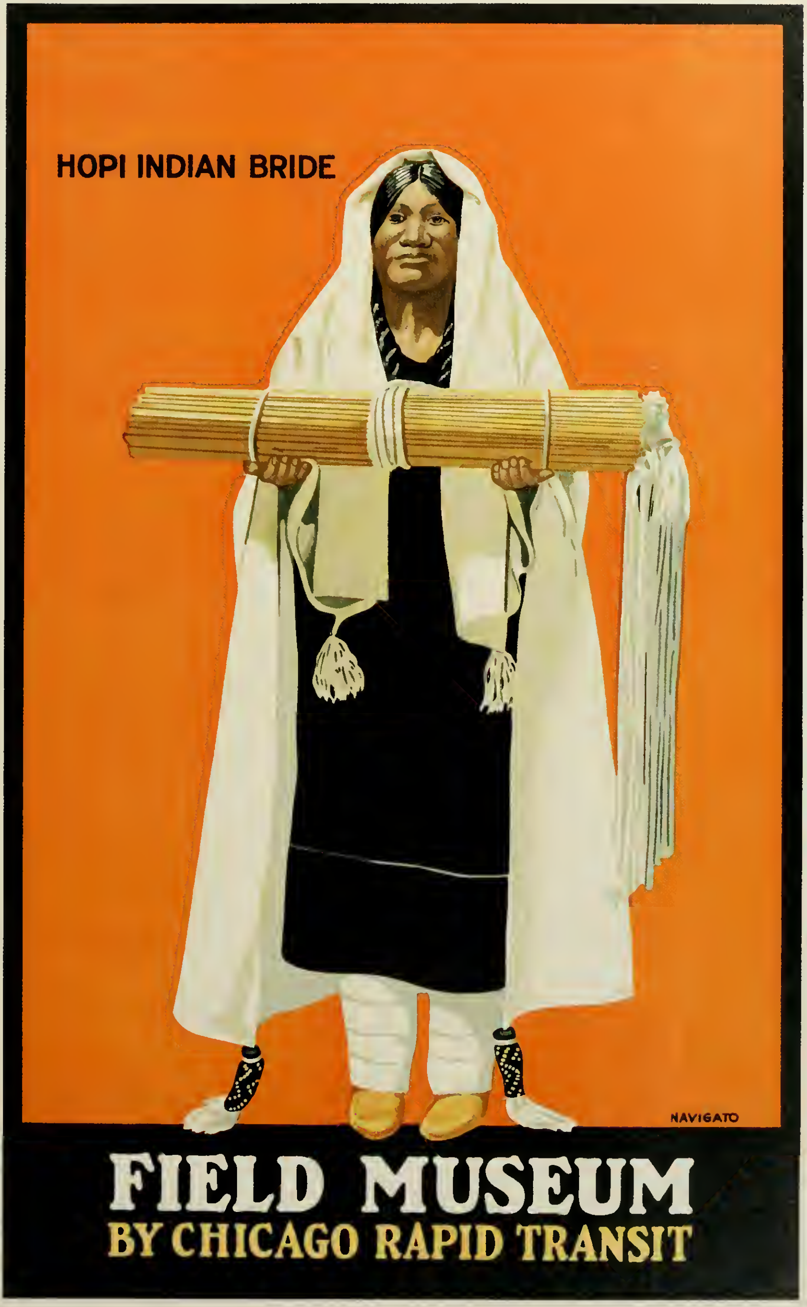
The Museum Opens daily at 9 a.m., closes at 6 p.m. Monday through Wednesday and 9 p.m. Thursday through Sunday. On Fridays, year-round, the museum is open to 9 p.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday. Obtain pass at reception desk, main floor.

Museum Telephone: 922-9410
Tutankhamun Information: 922-5910

September
1977

Field Museum of Natural History Bulletin


HOPI INDIAN BRIDE
NAVIGATO
FIELD MUSEUM
BY CHICAGO RAPID TRANSIT

**Field Museum
of Natural History
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September 1977
Vol. 48, No. 8

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Field Museum of Natural History
Founded 1893

President and Director: **E. Leland Webber**

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CONTENTS

3 **Field Briefs**

4 **Silver Anniversary for Bushman**
Chicago's famed gorilla came to Field Museum in 1952

7 **Gorillas in Captivity**
By William E. McCarthy

10 **Cannibals, Catalogs & Computers**
The AIMS project at Field Museum
By Lenore Sarasan, Marilyn J. Miller, and members of the Department of Anthropology

14 **In Search of Meteorites**
Account of recent field trip to the Southwest
By Paul Sipiera

18 **Members' Children's Workshops**

20 **Our Environment**

back cover **September and October at Field Museum**
Calendar of coming events

COVER

This poster advertising use of Chicago's Rapid Transit to visit Field Museum dates from the late 1920s or early 1930s. The representation of a Hopi Indian bride is based on a figure in the "Hopi Apartment" exhibit in Hall 7. The artist was Rocco D. Navigato, of Chicago, who died in 1962.

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Field Briefs

Grants Totaling $129,500 Awarded to Field Museum

Five grants totaling $129,500 have been awarded to Field Museum for a wide range of new and continuing research, education, and preservation programs. Continued support in the amount of $40,000 has been received from the National Science Foundation (NSF) for Floristics of Veracruz. This project—producing detailed systematics and ecological accounts of the plants of Veracruz—is a cooperative, international effort involving botanists at Field Museum and the Instituto de Investigaciones Sobre Recursos Bioticos of Mexico. The pilot project is explicitly designed for the comprehensive treatment of all plants of Mexico.

An NSF grant of $33,400, for continued support of the project entitled Care and Use of Systematic Collections of Fishes, is earmarked for employing additional personnel to reorganize the 1.3 million fish specimens in the museum's collection, An additional 130,000 specimens—some dating back to the 1890s—need to be identified, cataloged, and shelved. Part of the curatorial support money will go for a 50 percent expansion of storage areas.

The museum has also been awarded $28,100 from NSF for continued support of Flora of Costa Rica. The museum's Department of Botany has had a major interest in the plant life of Central America, and has perhaps the world's largest collection of plant specimens from that area. Through this grant, native and naturalized plants of Costa Rica are being inventoried to produce an encyclopedic botanical reference for use by scientists in related fields.

A grant of $25,000 from the National Endowment for the Arts (NEA) will be used for development and design of a comprehensive system of information and directional signage for the museum's exterior and interior. The Museum has also been granted $3,000 from NEA to support a Native American arts festival to be held in conjunction with new exhibits on Pawnee and Iroquois culture.

Staff Appointments

Larry Gene Marshall has joined the Department of Geology as visiting assistant curator of vertebrate paleontology. A major responsibility of Marshall's will be to organize the fossil mammal collection. Marshall obtained his Ph.D. in paleontology from the University of California in Berkeley.

Ronald W. Turner has been appointed assistant curator and head, Division of Mammals. He will oversee the general administration of the division as well as participate in research and field work. He earned his Ph.D. in ecology and systematics from the University of Kansas. Turner was an associate in mammals at the Museum of Natural History at the University of Kansas and has worked with the United Nations World Health Organization.

Linton Pitluga has joined the Department of Education as group resource coordinator, and will be responsible for marketing education programs to organized groups. He most recently served as director of the Cernan Space Center, River Grove, Il. Pitluga has an M.S. in science education from the State University of New York, Oswego.

Rick Shannon has been named exhibit designer, Department of Exhibition. He has designed model classrooms for the Cincinnati Department of Education and holds a B.S. in industrial design from the University of Cincinnati.

William J. Maurer is the new assistant development officer, Department of Planning and Development. He was most recently director of coorporate and foundation relations at the Chicago College of Osteopathic Medicine. Marshall holds a B.A. in history from Loyola (Chicago) University.

Trustees Named

Mrs. T. Stanton Armour, Robert O. Bass, and Edward R. Telling have been elected to five-year terms on the Board of Trustees of Field Museum. Donald Richards has been elected a life trustee.

Mrs. Armour, of Lake Forest, is corresponding secretary of the Women's Board of Field Museum and has been a museum volunteer since 1974. Robert O. Bass, of Chicago, is president and chief operating officer of Borg-Warner Corporation. He also serves as a director of SCM Corporation, Raymond Corporation, and Illinois Manufacturers' Association.

Edward R. Telling, of Northbrook, is senior executive vice president-field of Sears, Roebuck and Company and is a director of Allstate Insurance Companies, Homart Development Company, and American Can Company. Donald Richards, of Miami Beach, Fla., is a benefactor of Field Museum and, in 1946, founded the Donald Richards Bryological Fund, which supports the collection and study of mosses and related plants at Field Museum.

Ayer Film-Lecture Series

The ever-popular Edward E. Ayer film lecture series resumes October 1, with a new program featured each Saturday through November 26. The nine programs will be presented in the newly renovated James Simpson Theatre and start at 2:30 p.m. (seating begins at 1:45). Each program lasts about 90 minutes and is recommended for adults.

Access to the theatre is easiest by way of the new ground level west entrance. The west entrance provides free admission to the theatre; however, access to the rest of the Museum requires the regular fee or membership identification. Reserved seating is available for members and their immediate families.

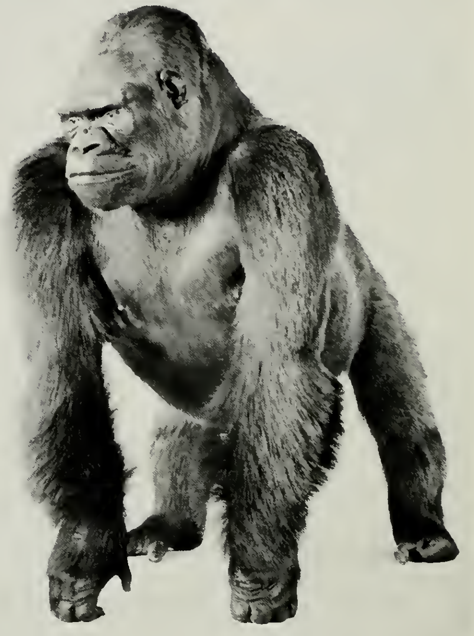
The October programs include "Switzerland Today," October 1; "Colorado," October 8; "Northwestern Adventure—Idaho, Oregon, Washington," October 15; "A New Norway," October 22; and "Ceylon—the Magic Island," October 29. A complete listing of the series programs will appear in the October and November *Bulletins.* ☐

Silver Anniversary for Bushman

After nearly a lifetime at Lincoln Park Zoo, the celebrated gorilla came to Field Museum, where he has continued to draw crowds for a quarter century

One of the perennially popular exhibits at Field Museum is Bushman, the magnificent specimen of lowland gorilla who has been in view there since 1952. After spending nearly all his life at Chicago's Lincoln Park Zoo, Bushman died on New Year's Day, 1951, at the age of 23. In life, he had been viewed by an estimated three million visitors a year, and his enormous popularity convinced officials that the presentation of Bushman at Field Museum would continue to serve an invaluable educative function.

Thus, in 1952, Bushman took up permanent residence at Field Museum, where he may now be seen in the Anniversary Exhibit (Hall 3). At the time of his installation Colin Campbell Sanborn, then curator of mammals, wrote the following piece on Bushman for the Bulletin.*



Bushman as he appears today at Field Museum.

Bushman of Lincoln Park Zoo, who died a year ago, has been mounted for permanent preservation at Field Museum and placed on exhibition. He thus is in the unique position of becoming his own monument. This makes pertinent some observations on the subject of gorillas in general.

Published references to gorillas based mainly on stories of natives appeared as long ago as 1625. The gorilla was not again mentioned until 1819, and it was not until 1847 that any actual specimens came to the hands of scientists.

It was in that year that Thomas S. Savage, an American missionary returning from Africa, stopped at the Gaboon River with the missionary stationed there, Rev. J. L. Wilson, who showed him the skull of a gorilla. Dr. Savage, being familiar with the chimpanzee, recognized the skull as that of a new animal and with Rev. Wilson's help secured four skulls and some bones of the animal. Dr. Savage and Dr. Jeffries Wyman, Hersey Professor of Anatomy in Harvard University, studied this material and gave the world the first description of the animal, which they named *Troglodytes gorilla.* The name gorilla was taken from the account of Hanno, who in his account

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**Excerpted from "Zoo's Famous 'Bushman' Becomes Own Monument," by Colin Campbell Sanborn, which appeared in* Chicago Natural History Museum Bulletin, *January, 1952, p. 5.*

of the Carthaginian explorations, described "wild men" found on the coast of Africa.

Since the original discovery, and with the further exploration of Africa, no less than seventeen other supposed types of gorillas have been described, each one from a new locality being thought to be different. However, with a greater amount of material available for comparison, the supposed distinguishing characters proved to be merely normal variation in the species. Today only two kinds of gorillas are recognized—the coast gorilla, *Gorilla gorilla gorilla* Savage and Wyman, and the mountain gorilla, *Gorilla gorilla beringei* Matschie.

The coast gorilla is found in that part of West Africa known as the Cameroons and French Equatorial Africa. The mountain gorilla lives in a narrow strip of highland forest, usually about 7,000 feet above sea level, in the eastern Belgian Congo.

Both gorillas are large animals, old males standing about six feet and in the wild weighing 350 pounds or more. The girth of the great chest is 63 to 64 inches, or more than five feet. The powerful arms have a girth of 18 inches and a length of 34 inches and the distance from fingertip to fingertip is about eight feet. The mountain gorilla differs from the coast gorilla by its longer and thicker coat, which is darker in color, by the presence of a beard, by a callosity on top of its head, and by its shorter arms and longer legs.

The first white man to shoot a gorilla was the well known French-American author, Paul du Chaillu, who went to West Africa in 1855. His highly colored account, for which the publishers are to be blamed, continued many of the myths by which public interest had been captured. In spite of all that has been published since, it is still believed by many that the gorilla walks upright, lives in trees, attacks hunters, and carries off women. The latter story is still being used by motion-picture producers to this day. Perhaps it is fortunate that they do not know the Malay story about attractive young Malay men being kidnapped and carried to their treetop nests by older female orangs.

It has been well established that the gorilla is a terrestrial mammal. It may rise on its hind legs, apparently in order to look over the top of bushes, but it does not travel in this erect posture. It moves on all fours, the arms resting on the knuckles of the hands, not flat on the palm. A study of the structure of the gorilla shows that it is not built to walk in an upright position.

The gorilla may ascend a leaning tree, but it does not climb nor does it travel from tree to tree by swinging from its arms. Its bed, also, is made on the ground and is never a nest of sticks in trees as so often described. The animal turns about to make a hollow in the ground and pulls into it for a bed such leaves, sticks, or vines as may be on the forest floor. New nests are made each night.

Gorillas associate in family groups composed of males, females, and young, with as many as twenty-five individuals living together. There are conflicting stories by reliable observers concerning their reaction to the presence of man in their immediate vicinity. The rule appears to be that when approached the group will move off, but if followed, old males will show more or less fight, depending on the individual. In other words, offered enough provocation a gorilla will make some show of defiance, barking, beating its chest, and even charging to within a certain distance of its pursuer. . . .

It is certain that gorillas need special and individual care and grow and thrive when this is provided. The late Bushman of Lincoln Park Zoo in Chicago is an outstanding example. His birth is estimated at January, 1928, and he was received by the zoo in August, 1930. He died on January1, 1951, at the approximate age of 23 years. This

Young Bushman with his keeper Eddie Robinson. From the time he arrived at Lincoln Park Zoo in 1930 until his death on New Year's Day, 1951, Bushman was cared for by Robinson.

Chicago Park District

is close to the record age for a gorilla, but chimpanzees and orangutans have lived in zoos for slightly more than 26 years.

Bushman was a coast gorilla from the French Cameroon, raised from a baby by Dr. W. C. Johnson, a missionary at Yaounde. He was acquired by Jules L. Buck, animal collector, and sold to Lincoln Park Zoo for $3,500 in 1930, at which time he weighed but 38 pounds. Keeper Eddie Robinson, by his love, understanding care, and firm hand, raised Bushman to his prime when he stood 6 feet 2 inches, weighed 565 pounds, was valued at from $125,000 to $250,000, and was voted by the American Association of Zoological Parks and Aquariums "the most outstanding and most valuable single animal of its kind in any zoo in the world." This is an achievement and sets a record that will long stand.

Bushman was not given special training or taught tricks. Neither was he subjected to psychological studies. Keeper Robinson took Bushman outside for exercise at the end of a 75-foot rope nearly every morning for four and a half years. Wrestling, racing, and football were sports at which Bushman became adept, but he was never offered a place on any team. He was always obedient and as gentle as a six-year-old 170-pound gorilla could be expected to be. The time soon came, however, when Bushman did not want to return to his cage. A slap in the face from Robinson caused him to dash for the monkey-house and across the basement, dragging Robinson with him. After some petting he returned to his cage, which he was never allowed to leave again.

He still obeyed Robinson's commands, would sit on his chair, which was on scales so that a record of his weight could be kept. He liked to be fed by hand through the bars and at no time became ill-tempered or vicious.

His personality appealed to the public and an estimated three million people came to see him every year. News of his first serious illness in 1950 brought 120,000 sympathizers in one day to call on him. His only fears were of snakes, turtles, and crocodiles.

On his death the Chicago Park District presented him to Field Museum where he was preserved for posterity in a lifelike position by staff taxidermists Leon L. Walters and Frank C. Wonder, and artist Joseph B. Krstolich. For a month he was returned to the monkey house, a part of which was dedicated with fitting ceremonies on October 19 as Bushman Hall. . . .

Bushman "shoots" former Lincoln Park Zoo Director Alfred E. Parker.

Chicago Park District

Snowflake, the only known albino gorilla, now in the Barcelona, Spain, zoo. United Press International

Gorillas in Captivity

By William E. McCarthy

SEEMINGLY CONTENT GORILLA FAMILIES are now enjoying their own style of gracious living in Chicago's Lincoln Park Zoo's Great Ape House, opened in July of last year. Some of these gorillas—the last species of great apes to be scientifically described—will produce offspring for years to come, and could reach the ripe old age of 45 or even 50.

But captive gorillas were not always so lucky, and their wild kindred in the African tropics continue to have a rather brief life expectancy. Both subspecies—the lowland gorilla and the less frequently captured mountain gorilla—are now classified as endangered, and thus protected—but they continue to face many external threats to their existence, and most die before reaching 20.

The first gorilla to be seen in the United States arrived in Boston in 1898; it survived only a few days, however. In 1911 a young female lowland gorilla from West Africa was brought to New York City's Zoological Park; she, too, died shortly after her arrival. This high mortality was typical of the 20 or so gorillas imported into Europe and the United States before 1914; 18 died within a year.

A variety of factors contributed to the high death

William E. McCarthy is a volunteer staff writer.

rate. Young gorillas have a better chance of surviving the shock of capture and displacement, but the gorilla mother as we might expect does not easily relinquish her young. It was commonplace in former times for collectors to expedite matters by killing the mother; in the process, the young frequently suffered psychological as well as physical trauma.

An inadequate diet was also a serious problem; gorillas were given the same fruit diet as other apes, instead of the special selection of fresh fruits and vegetables that today's experts believed to be essential for their health. Consequently, many of the captive animals languished and died of malnutrition or outright starvation.

If poor diet didn't kill them, there was a good chance that they would succumb to any one of a number of infectious diseases. Gorillas, especially the young, are highly susceptible to pulmonary ailments such as colds, pneumonia, and tuberculosis. Yaws, which affects millions of humans in the tropics, attacks gorillas as well; and they are also prey to a variety of parasites, the most serious being a threadlike gastrointestinal nematode which is known only to attack gorillas. It is a more serious affliction in captive gorillas than in wild ones. The emotional and constitutional upset that follows capture weakens the animal, and lowers its resistance to the parasite.

To ease the shock of transition to captive life, an acclimatization station was set up by the Barcelona, Spain, Zoo in Equatorial Guinea, on Africa's west coast. There, professionals built up the disease resistance of the young animals with vitamins, treated them for parasites, and gradually acquainted them with their not too distant relative, *Homo sapiens*.

The most famous graduate of this station (closed in 1969) is a male lowland gorilla named Snowflake, now in the Barcelona Zoo. Captured when about two years old, Snowflake is the world's only known white gorilla. (Unlike true albinos, his eyes are blue rather than pink.) Snowflake has adapted well to captivity—so well, in fact, that he has fathered a baby.

NOW THAT IT IS ILLEGAL to import gorillas into the United States, greater interest has been taken in breeding the captive animals; but this process—as is true with many animal species, be they mammal, bird, or reptile—is difficult to promote in the synthetic environment of a man-made enclosure. Not until 1956 were zookeepers able to satisfy the needs of gorillas to the extent that a baby was conceived and born in captivity. On December 22 of that year the first captive-born gorilla, Kolo, began life at the Columbus, Ohio, Zoo, after a gestation period of eight and a half months. Meanwhile, zookeepers have obviously learned something more about the ways of gorillas, for in the two decades since Kolo's birth about 130 have been born in captivity.

of Mikeno
©1921

Ron Testa

Bronze life-size bust of gorilla by Carl Akeley. Better known for his taxidermy, Akeley mounted the two fighting bull elephants now on view in Stanley Field Hall. He served on the Field Museum staff from 1896 to 1909.

While gorillas almost always have single births, a female in the Kansas City Zoo became pregnant with twins in 1974, but both were aborted. A rare case of live and healthy twins was recorded on May 3, 1967, in the Frankfurt, Germany, Zoo when a lowland gorilla named Makula gave birth to fraternal twins—both females.

Ronald Nadler, a psychologist at the Yerkes Center for Primates in Atlanta, Georgia, believes that the key to breeding gorillas is social interaction with other members of the species. Primate specialists at various zoos have gradually come around to Nadler's way of thinking, and a few institutions, like Lincoln Park Zoo, have replaced the traditional barred, single-animal cages with large enclosures for family groups.

Other institutions that now have such facilities include Houston Zoological Gardens and Krefeld, West Germany, Zoo. Another will be Brookfield, Illinois, Zoo's Tropic World for Apes and Monkeys, now under construction. Lincoln Park's Great Ape House, which accommodates orangutans and chimpanzees as well as gorillas, simulates the environment of a tropical rainforest, with artificial thundershowers occurring twice a day.

Lincoln Park now has 18 gorillas, with three on loan (a male adult and two juveniles) to the London Zoo. The gorilla groupings are changed once or twice a year to enhance the likelihood of breeding success. The zoo's first captive-born gorilla was Kumba, born July 22, 1970. The most recent (the zoo's seventh) was born July 23, 1977.

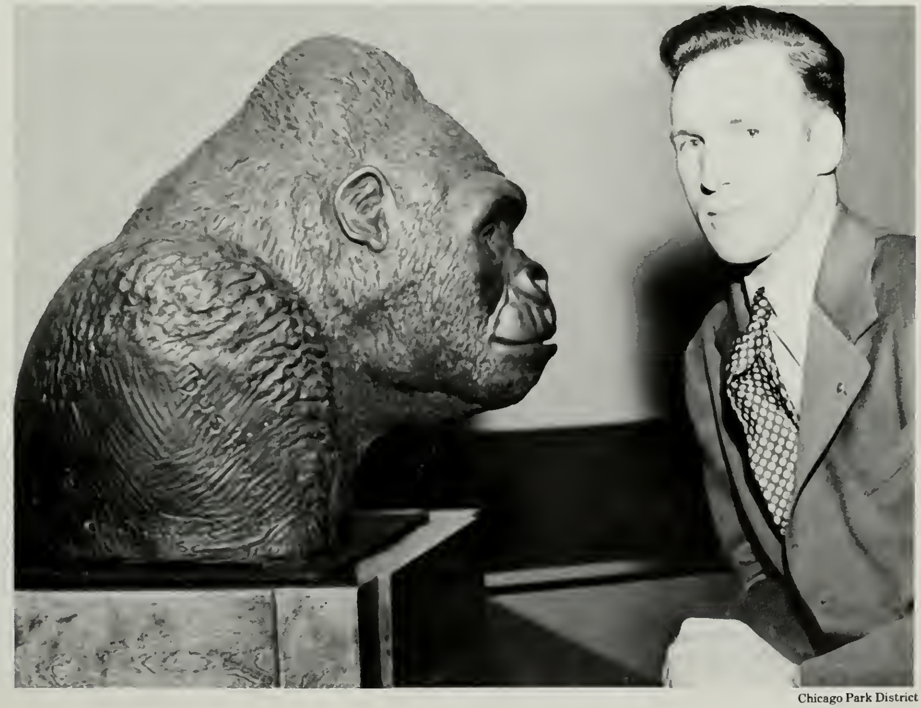
A Lincoln Park gorilla who has never mated is Sinbad, acquired by the zoo in 1948 when about a year old. A solitary resident of the old primate house, Sinbad may be incapable of living peaceably with others of his species: When a female was placed in his cage as a potential mate, he attacked her; the keepers finally had to separate the animals by blasting them with water from a fire hose. Moving the unpredictable ape to a new environment would require sedation, but his keepers feel this would be dangerous, possibly fatal, for an animal of his age (30 years) and weight (480 lbs). So Sinbad, the third oldest gorilla in captivity, has remained alone and celibate.

The dean of captive gorillas in the United States is 46-year-old Massa, a male lowland gorilla at the Philadelphia Zoo who has been in this country since 1931. The oldest female is 39-year-old Caroline, in Central Park Zoo.

THE LARGEST GORILLA is believed to have been Mbongo, a lowland male who died at the San Diego Zoo in 1942. His authenticated weight was at least 645 lbs shortly before his death. Unsubstantiated claims to the weight record include that of St. Louis Zoo's Phil, who reportedly weighed 776 lbs. With excessive weights now considered unhealthy (males in the wild rarely exceed 450 lbs), it is no longer fashionable to allow gorillas to grow much heavier than 550 lbs. Chicago's Bushman weighed 565 in April 1950, but he was 23 lbs lighter when he died eight months later.

The total number of lowland gorillas now in captivity is estimated to be 450. (The *International Zoo Yearbook*, Vol. 17, lists 424 as of January 1, 1976, with a few zoos not reporting.) About 200 are males, 250 females. Only about 15 mountain gorillas are in captivity, 5 male, 10 female. The only three of this subspecies in the United States are at the Oklahoma City Zoo, one being on loan from the Bronx Zoo and another on loan from the Tel Aviv Zoo.

The purchase price most often mentioned for a gorilla today is $15,000, but this is a meaningless figure since gorillas can no longer be imported here. Although some nations continue to purchase gorillas from wild animal dealers, it is reassuring to note that even before these animals were classified as endangered, most U.S. zoos had informally agreed not to obtain them in this way; thus discouraging the slaughter of wild females. In the light of currently successful breeding programs, there is good reason to expect that the number of gorillas in captivity will continue to multiply, and that there will never be any future need to capture these animals in the wild.



Bronze bust of Bushman. The identity of the sculptor (the man in the photo?) and the present location of the fine bust are a mystery.

Chicago Park District

CANNIBALS, CATALOGS & COMPUTERS

The AIMS Computerization Project at Field Museum

By Lenore Sarasan, Marilyn J. Miller, and members of the Department of Anthropology.

A COMPUTER HAS BECOME a highly valued member of Field Museum's Department of Anthropology. This July, staff anthropologists started moving more than 300,000 archaeological and ethnological specimens—about 75 percent of the total anthropology collections—into a new modular storage area. With the help of computer programs designed specifically for the purpose, the staff is making an inventory of every specimen moved.

"This move is an enormous job, but it is giving us the chance to do the first comprehensive inventory of our collections since Field Museum was founded in 1893," says Joyce Korbecki, departmental assistant. "When we finish, we will have a new kind of catalog which will be of tremendous use, not only to us, but also to visiting scientists and the Museum's public, as well. We are really excited by what the future holds."

The new storage area, recently completed as part of Field Museum's current renovation program, will house anthropological specimens of all shapes, sizes, and descriptions. These artifacts, collected from all over the world since the Museum began, have been stored until now in rooms scattered throughout the institution. The present move brings them together for the first time in a modern, environmentally controlled, four-floor facility made possible by grants from the National Endowment for the Arts, the National Science Foundation, and the Museum's recent successful $25-Million Capital Campaign. Because of renovation activities throughout the building, most of the old anthropology storerooms must be vacated within the next 12 months.

Phyllis Rabineau, custodian of the anthropology collections, explains that two winters ago the department began investigating inventory methods for the move. "We had wonderful help from many people in computer sciences at Illinois Institute of Technology, especially Charles Bauer, Peter Greene, and Richard Weiland. Computer science classes from IIT came here and during pilot moves experimented with describing specimens, which carry only their catalog numbers for identification. We examined every technique we could think of—note cards, punch cards, mark-sensitive pads and cards, and so forth—to gather information about the artifacts. All of us, however, soon realized that anthropology specimens are too varied, often too fantastic, to be described easily by just looking at them, even by our curators. We were forced to conclude that in order to move and inventory at the same time we had to have easy access to our catalog information at the time the specimens passed through our hands."

"We faced a serious dilemma," recounts Korbecki. "The only way to achieve instant access to all our catalog material was to convert 78 cumbersome, handwritten ledgers to machine-readable form—an awesome task even without tight time restraints." A survey of available computer programs failed to turn up any efficient and economical way of entering data on so many specimens. The department faced the choice of abandoning the plan to do an inventory during the move or devising their own system of computerization. They decided to try to design their own system.

Only five months before the move began, AIMS (Anthropology Information Management System) was born. Lenore Sarasan, systems analyst for AIMS, recalls the project's beginnings: "The first few weeks were not easy. The move was set to begin in less than five months and we needed to maximize the number of specimens we could enter data on per hour. We quickly realized that the job was too great to be accomplished using traditional data entry techniques so we had to develop an entirely different approach to data entry. The result is a set of pro-

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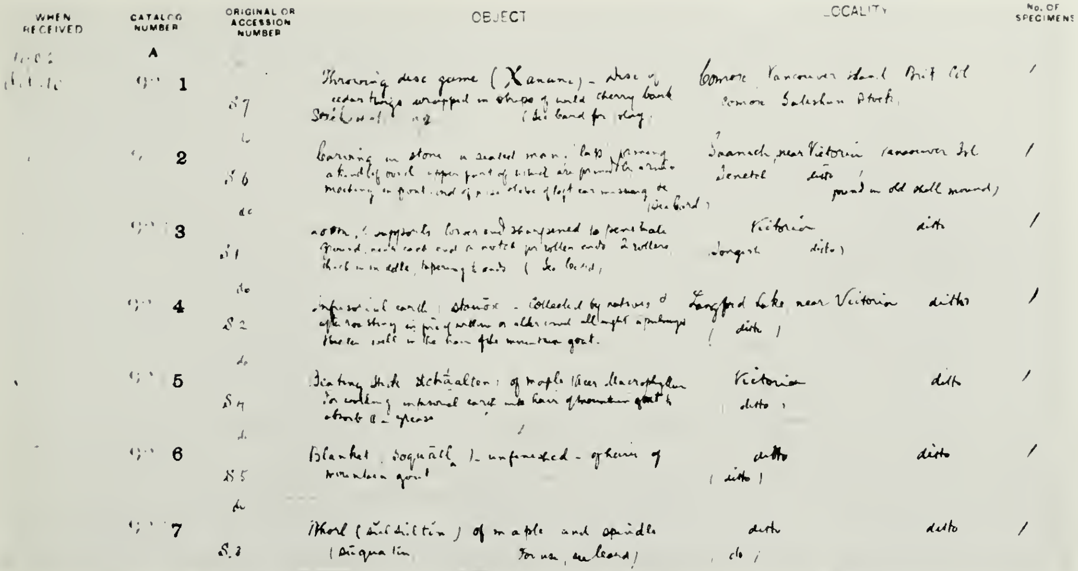
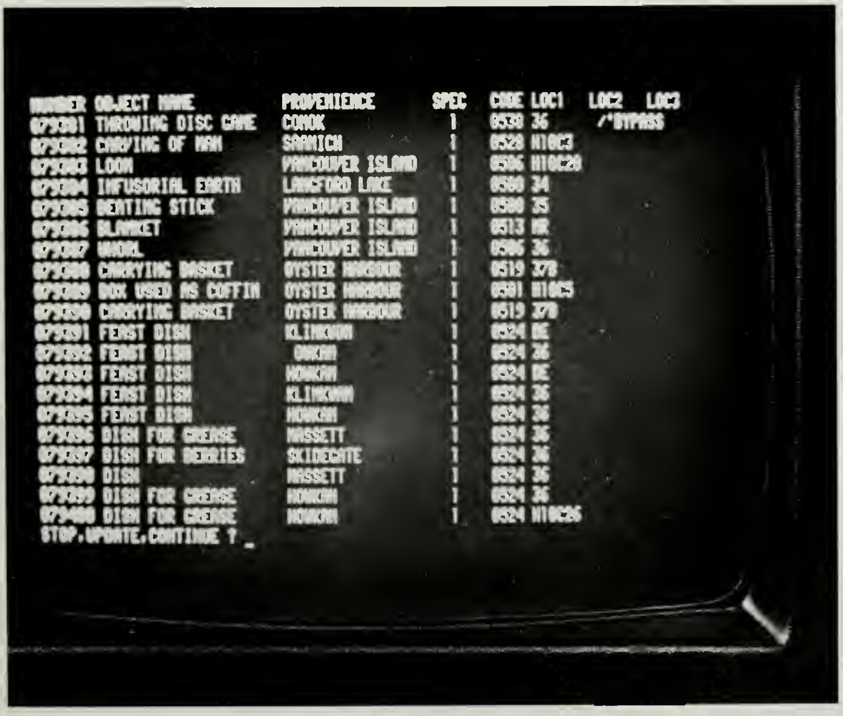
Lenore Sarasan is the systems analyst for the AIMS project; Marilyn J. Miller is a research writer and editor.



WHEN RECEIVED	CATALOG NUMBER	ORIGINAL OR ACCESSION NUMBER	OBJECT	LOCALITY		No. OF SPECIMENS
[illegible]	A 1	87	Throwing disc game (Xanane) - disc of cedar twigs wrapped in strips of wild cherry bark Stick used [illegible] (See band for [illegible])	Comox Vancouver Island Brit Col Comox Salishan Stock.		1
	2	86	Carving in stone a seated man. [illegible] a bundle of wood, upper part of which are [illegible] in front and [illegible] of left ear missing (See Card)	Saanich near Victoria Vancouver Isl Senetcl ditto (found in old shell mound)		1
	3	81	Loom, 2 supports [illegible] and sharpened to penetrate ground, each end a notch for roller ends, 2 rollers thick in middle, tapering to ends (See Card)	Victoria Songish ditto	ditto	1
	4	82	Infusorial earth (stowox) - Collected by natives & after roasting in fire of willow or alder wood all night [illegible] then [illegible] in the hair of the mountain goat.	Langford Lake near Victoria (ditto)	ditto	1
	5	84	Beating stick (Schaalton) of maple (Acer Macrophyllum) for working infusorial earth into hair of mountain goat to absorb the grease	Victoria (ditto)	ditto	1
	6	85	Blanket (Soquall) - unfinished - of hair of mountain goat	ditto (ditto)	ditto	1
	7	83	Whorl (Sulchiltin) of maple and spindle (Suquatin for use, see Card)	ditto (do)	ditto	1



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NUMBER OBJECT NAME          PROVENIENCE       SPEC  CODE LOC1   LOC2   LOC3
079381 THROWING DISC GAME   COMOK              1    0539 36       /*BYPASS
079382 CARVING OF MAN       SAANICH            1    0528 H10C3
079383 LOOM                 VANCOUVER ISLAND   1    0506 H10C20
079384 INFUSORIAL EARTH     LANGFORD LAKE      1    0500 34
079385 BEATING STICK        VANCOUVER ISLAND   1    0500 35
079386 BLANKET              VANCOUVER ISLAND   1    0513 HR
079387 WHORL                VANCOUVER ISLAND   1    0506 36
079388 CARRYING BASKET      OYSTER HARBOUR     1    0519 37B
079389 BOX USED AS COFFIN   OYSTER HARBOUR     1    0501 H10C5
079390 CARRYING BASKET      OYSTER HARBOUR     1    0519 37B
079391 FEAST DISH           KLINKWAN           1    0524 DE
079392 FEAST DISH            KAKAN             1    0524 36
079393 FEAST DISH           HOWKAN             1    0524 DE
079394 FEAST DISH           KLINKWAN           1    0524 36
079395 FEAST DISH           HOWKAN             1    0524 36
079396 DISH FOR GREASE      MASSETT            1    0524 36
079397 DISH FOR BERRIES     SKIDEGATE          1    0524 36
079398 DISH                 MASSETT            1    0524 36
079399 DISH FOR GREASE      HOWKAN             1    0524 36
079400 DISH FOR GREASE      HOWKAN             1    0524 H10C25
STOP.UPDATE.CONTINUE ? _
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▲ *Portion of a page of an anthropology catalog ledger treating specimens from the Indians of British Columbia. The double page is 14½ x 21 inches and the catalog volume weighs 9 lbs. Seventy-eight ledgers have been filled with such entries—about 4,000 entries each—since the first was recorded in 1904.*

The catalog page shown above translated to the video screen of the computer terminal. The material has been edited and is ready for transmission to the computer, where it will be stored on a magnetic disc. The transmission command also brings a new page onto the screen with column headings and 20 catalog numbers.

grams we call PANDORA. PANDORA is simple in concept, easy to use, and has exciting possibilities for all the scientific departments at Field Museum as well as other museums."

Three students from the University of Illinois (Chicago Circle Campus), George Wolf, Reynaldo Granja, and Ed Martin, took Sarasan's specifications for the new data entry approach and transformed her ideas into the PANDORA computer programs. And finally, last April, the entry of catalog data into computers at the UICC began.

Using a cathode ray tube (TV screen) terminal, data inputters "build" a page of the old catalog onto the terminal screen and then telecommunicate the data to a computer at the university. The UICC computer center made every effort to ensure the success of the project. Eb Klemens, George Yanos, and Louis Warshawsky lent their expertise, often assisting with special arrangements when such action was needed. Six data fields were selected for use during the inventory: catalog number, brief object description, provenience, number of specimens, subject-index code, and present storeroom location.

Directed by PANDORA, the computer automatically enters the 20 catalog numbers and headings for the data fields contained on each page of the old catalogs onto the terminal screen, eliminating numerical errors. The remainder of the catalog page is then typed on the screen by entering data in columns, *i.e.*, 20 object names are entered, then 20 proveniences, and so on. This columnar approach, which is the secret of PANDORA's speed, substantially minimizes eye fatigue, because the inputter does not have to follow entries back and forth across the oversized, handwritten catalog pages. He or she simply works down the page.

Columnar entry also takes advantage of the substantial repetitive material in the catalogs by using another special PANDORA feature, the "repeat factor," which allows an inputter to write any item of data from 1 to 20 times. For example, all the items on a catalog page may come from the Solomon Islands. The inputter can type in "20" and "Solomon Islands" once and the computer writes the information *Solomon Islands* down the provenience column 20 times. This repeat feature not only eliminates a substantial amount of typing—more than a thousand characters of data per page are entered by actually typing in about 150 characters—but also provides the inputter with frequent pauses that lessen fatigue and result in greater accuracy.

Another feature unique to PANDORA is the "beep function," as simple as it is useful. PANDORA is a set of interactive programs which enables the computer to respond to the inputter and give commands to the terminal after each item of data is typed. Since the university computer is serving many terminals at once, response time varies. The beep function is an audio signal that eliminates the need to glance at the terminal screen, letting the inputter know when the computer is ready to accept more information.

Once an entire page has been entered, the inputter can briefly proof for errors which can be corrected immediately, and if there are none, he or she can enter the data into the computer with the stroke of a single terminal key which also prompts the computer to put up the numbers for the next page.

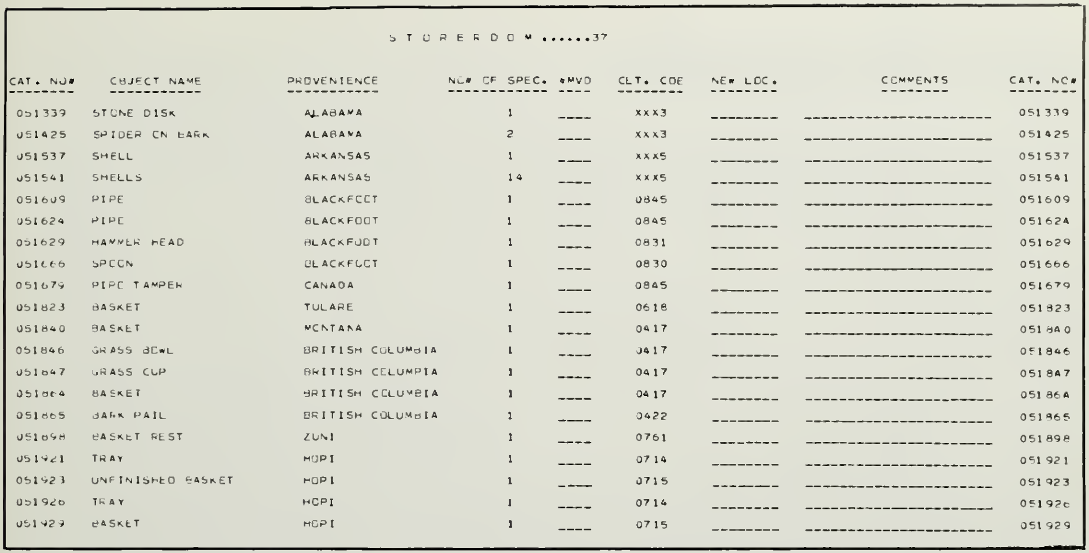
"This is the first radical innovation in our collection management procedures in 86 years!" cheerfully reports Donald Collier, curator emeritus of Middle and South American archaeology and ethnology, who is supervising not only the AIMS Project but also the entire storage move. "AIMS is tailored to our needs and fits our traditional cataloging procedures beautifully."

The speed and accuracy afforded by the AIMS approach is impressive—checking of the printouts has uncovered almost no data errors and very few typographical errors, in spite of the fact that the average rate of entry was between 300 and 600 specimen listings, of up to 80 characters each, per hour. "This phenomenal rate, however, would have been useless if it hadn't been coupled with the dedication and enthusiasm of our data inputters—Susan Campbell, Timothy Liston, Patty Figel, Linda Allen, and Barbara Davis," explains Collier. "At times they kept the terminal operating 20 hours a day, seven days a week to enter all the data needed before the move began."

One of the inputters, Susan Campbell, who worked the night shift for a month to ensure the project's success, comments on the experience. "It was absolutely fascinating. The items ran the gamut from a hand cooked at a cannibal feast to Sitting Bull's shirt, but the more anomalous objects stand out. One was 'Base with seven ornate figures. Figures missing'—which I was tempted to enter as 'Figureless base.' Another was '*Half* a potsherd!' "

Once all necessary data on the specimens to be moved had been computerized, 20 special catalog books were printed by the computer, each of which numerically listed the specimens in a particular storeroom. During the current move, anthropology staff are using these books to look up every specimen as it is moved into the new storage facility. They record its new location in the modern facility, note whether the specimen with a given number fits its catalog description, and insert relevant remarks. All these newly collected data are then computerized and transmitted to the computer file as soon as each old store-

After the move is completed in 1978, computers will be used to print up a list of all the specimens that should have been (but apparently were not) carried out of the old storerooms. These are the missing specimens and the curators can begin looking for them. Similar lists will be



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                                        S T O R E R O O M ......37

CAT. NO#   OBJECT NAME          PROVENIENCE          NO# OF SPEC.  #MVD   CLT. CDE   NEW LOC.          COMMENTS            CAT. NO#
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 051339   STONE DISK             ALABAMA                   1        ____    XXX3      ________  ________________________    051339
 051425   SPIDER ON BARK         ALABAMA                   2        ____    XXX3      ________  ________________________    051425
 051537   SHELL                  ARKANSAS                  1        ____    XXX5      ________  ________________________    051537
 051541   SHELLS                 ARKANSAS                  14       ____    XXX5      ________  ________________________    051541
 051609   PIPE                   BLACKFOOT                 1        ____    0845      ________  ________________________    051609
 051624   PIPE                   BLACKFOOT                 1        ____    0845      ________  ________________________    051624
 051629   HAMMER HEAD            BLACKFOOT                 1        ____    0831      ________  ________________________    051629
 051666   SPOON                  BLACKFOOT                 1        ____    0830      ________  ________________________    051666
 051679   PIPE TAMPER            CANADA                    1        ____    0845      ________  ________________________    051679
 051823   BASKET                 TULARE                    1        ____    0618      ________  ________________________    051823
 051840   BASKET                 MONTANA                   1        ____    0417      ________  ________________________    051840
 051846   GRASS BOWL             BRITISH COLUMBIA          1        ____    0417      ________  ________________________    051846
 051847   GRASS CUP              BRITISH COLUMBIA          1        ____    0417      ________  ________________________    051847
 051864   BASKET                 BRITISH COLUMBIA          1        ____    0417      ________  ________________________    051864
 051865   BARK PAIL              BRITISH COLUMBIA          1        ____    0422      ________  ________________________    051865
 051898   BASKET REST            ZUNI                      1        ____    0761      ________  ________________________    051898
 051921   TRAY                   HOPI                      1        ____    0714      ________  ________________________    051921
 051923   UNFINISHED BASKET      HOPI                      1        ____    0715      ________  ________________________    051923
 051926   TRAY                   HOPI                      1        ____    0714      ________  ________________________    051926
 051929   BASKET                 HOPI                      1        ____    0715      ________  ________________________    051929
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One page of the printout of all the specimens in a storeroom listed in numerical order. This printout is specially formatted to make an inventory of the objects as they are moved into the new storage facility and to record their new locations.

generated by the computer to account for all specimens on exhibition and those remaining in unmoved storage areas.

In addition to making an inventory possible, AIMS, which is being funded by a grant from the National Endowment for the Arts in Washington, D.C., will lead to several other kinds of printed outputs. New catalog cards will be produced by computer printers for use in the new storage facility, special listings will be made on ethnic groups and geographical areas, and two new sets of master catalog books will be produced, one for the department office and another for the storage facility.

The overall costs of this pioneering project are estimated at about $18,500. This sum includes the purchase of various kinds of equipment, consultant fees, programming fees, salaries for terminal operators, time on the computer, printout costs, data-bank storage costs, and so forth.

While AIMS was designed to achieve the specific, necessary goal of helping with the inventory and move, plans are being made to expand the data in the computerized catalog file and to develop AIMS to handle many of the routine and special chores done around museums. The department is seeking new grants to investigate these further applications and to acquire a minicomputer. Much can be said in favor of such an acquisition by one of the world's largest and oldest museums of natural history. A minicomputer could not only handle present and future needs in the Department of Anthropology, but elsewhere in the scientific, educational, and administrative departments of the institution.

Some future applications being considered are the development of more simplified, more efficient, more accurate methods of accessioning and cataloging specimens and processing loans—highly repetitive work now done by hand. There is also the need often raised by scholars and laymen for special catalog information on popular and esoteric parts of the collections which is all but impossible to gather using old methods.

"We certainly want to keep improving and developing AIMS, if at all possible," remarks John Terrell, associate curator of Oceanic archaeology and ethnology. "Our system has proved to be less expensive and far easier to manage than other computer approaches suggested for museum applications. If museums are to keep pace with the ever increasing demands made on them by the public and scientific communities, it is inevitable that computers will be needed in the future more and more. But no one, we believe, should venture into using computers until they have a well defined goal in sight that can be reached in no cheaper, easier way. Realistic and attainable aims should be defined. Later, if new goals arise as the earlier ones are achieved, it is time to go on to bigger and brighter things. In short, our philosophy is: Think small, think simple, be realistic, and stay open-ended. Don't try to create the Platonic, perfect system. Take a tip from nature, instead. Evolve it."

Whatever the course of the future, it is clear that computerization has already proved to be invaluable to Field Museum.

In Search Of Meteorites

By Paul Sipiera

UFOs and other phenomena of extraterrestrial origin have aroused a good deal of public interest in recent years. The only confirmed "visitors" from outer space, however, have been meteorites.

These are chunks of metal or stone believed to have been fragments of a developing planet situated somewhere between the orbits of Mars and Jupiter, but this supposed planet never finished forming. The gravitation of Mars and Jupiter, according to this theory, prevented the smaller bodies from accreting into a planet-sized object. Since that interruption—presumably billions of years ago—an infinite number of these fragments of space debris have been pulled out of their original orbits by the gravitational forces of both Mars and Jupiter or have been knocked into highly eccentric orbits by colliding with one another.

Many of these fragments now have orbits that intersect Earth's and, as a consequence, millions of microscopic particles collide with the Earth each day; a few larger fragments are seen at night as meteors, or "shooting stars." Occasionally, a particularly large meteor will be pulled in by the Earth's gravity, and a brilliant fireball is observed during its brief passage through our atmosphere. It is from such fireballs that most meteorites originate.

Meteorites are relatively rare objects, and their discovery is cause for great excitement among geologists. Although most meteorites fall into the oceans, enough

Dick Umstot, of Odessa, Texas, with his electronic metal detector, was a boon to the Field Museum-Harper College search team. He is shown here with Valerie Ocker, of Hoffman Estates, Illinois, who holds a newly found two ounce iron meteorite.

The Bacubirito meteorite; an iron meteorite found in Sinaloa, Mexico, in 1863.

fall on land to provide scientists with about 6 to 10 new specimens each year. Most are discovered as "finds"—those which have been lying on the Earth's surface for countless years. But the ones that cause the greatest excitement are those that are actually observed falling. One such famous meteorite is the 1938 Benld, Illinois, fall. This stony four-pound meteorite crashed through a garage roof, penetrated the roof and back seat of a car, bounced off its muffler, and became entangled in the springs of the seat cushion. (The Benld meteorite is now on view in Hall 34.) Obviously not all falls are quite this spectacular or so accessible to human observation, but meteorites are continually falling to Earth, and there is no way of predicting where or when the next may fall.

New meteorites are currently the object of a special search by the Department of Geology. In response to a publicity campaign, hundreds of reports and numerous specimens have come to the Museum from all over the United States during the past two years. In spite of this seemingly good response, however, not a single previously unreported meteorite has come to light.

In 1976 it was decided to adopt the highly successful meteorite recovery methods of H. H. Nininger, one of the early pioneers in the science of meteoritics. By his method, a flat, dry, relatively rock-free geographic site is selected for the search and a team armed with descriptive literature and a few meteorite specimens for comparison canvasses area residents to learn if any objects resembling a meteorite have been seen. Although a meteorite can fall in any location, certain areas, because of their particular geography and climate, have produced more meteorites than others. Meteorites in warm, moist climates deteriorate much more rapidly than those in cold, dry climates. In the Great Plains states, where rocks are generally uncommon and farmers are continually plowing, a meteorite can "stick out like a sore thumb." It was into just such an area that our ten-person research team (my-

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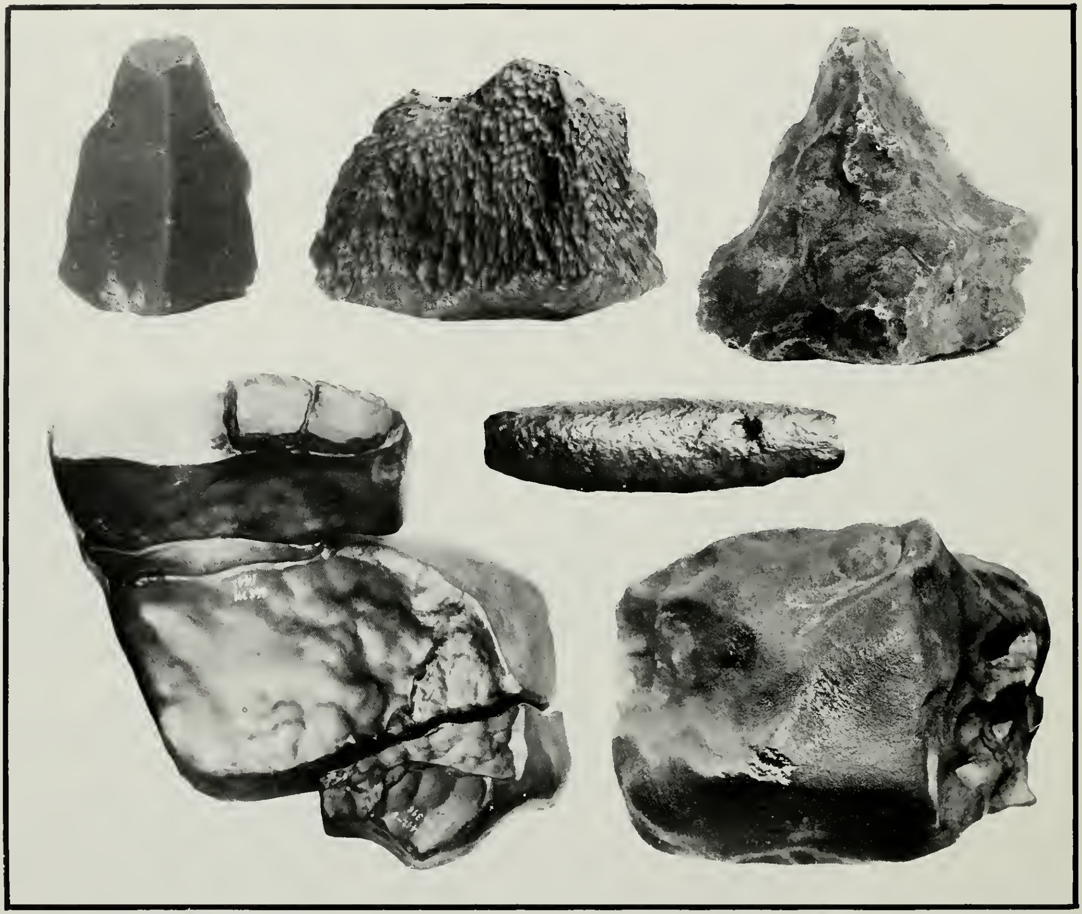
Paul Sipiera has been a visiting scientist at Field Museum and is an instructor in geology at William Rainey Harper College.



A sampling of stone and iron meteorites. Clockwise from top left: Stone meteorite that fell in Brown County, Texas, in 1909; 8½ x 6 inches. Stone meteorite that fell in Bath County, Kentucky, in 1902; 6¾ x 5 inches. Iron meteorite found in San Miguel County, Colorado, in 1912; 5½ x 7 inches. Iron meteorite found in Greene County, Tennessee, in 1842; 4 x 10 inches. Stone meteorite (the Benld meteorite) that fell in Macoupin County, Illinois, in 1938; 7½ x 9 inches. Stone meteorite that fell in Bihar, India, in 1861; 7½ x 9 inches.

self, two volunteers, and seven students) from Field Museum and William Rainey Harper College, of Palatine, Illinois, began our investigations in May of this year.

THE REGION CHOSEN was the West Texas Plains, which met the basic requirements quite well and which had been very productive of meteorites in the past. Since many area residents were already familiar with meteorites, the chances were considered highly favorable for finding an entirely new specimen.

Before our arrival, local newspapers obliged our request to publish articles on meteorites and the planned activities of the search team. Responding readers were subsequently interviewed and their specimens examined. Past experience had conditioned us to be a bit skeptical of reported finds, but in the case of W. E. Hollingsworth, of Plainview, Texas, our follow-up of his find was fortunate indeed. The object he had discovered while plowing a field in 1938 proved to be a genuine, 4.4-pound stony meteorite.

We could not be certain whether Hollingsworth's was a totally new meteorite or part of a meteorite shower that fell on the Plainview area early in this century. For the moment it did not matter. What was significant was that we actually had our first meteorite! Even though subsequent search of the area of his discovery failed to turn up any additional specimens, we were not disappointed.

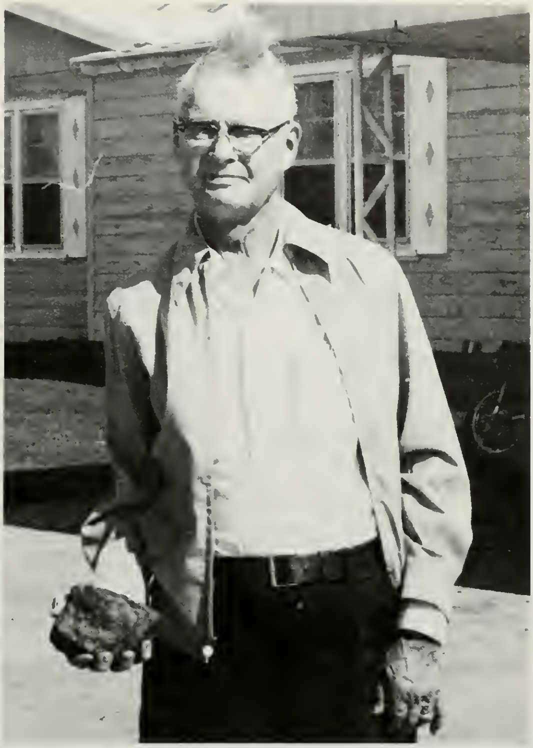
Our next area of study was the site of an ancient meteorite impact crater near Odessa, Texas. Having visited the famous meteor crater some 220 miles northeast of Phoenix, Arizona, I was expecting to find a crater at least as impressive. But this crater, about 500 feet wide and 30 feet deep, is now largely filled in, and virtually nothing is being done to preserve it. Although the crater itself was somewhat disappointing, our visit to the office of the local newspaper, the *Odessa American*, was a productive one. The newspaper gave us the names of several readers who believed they had meteorites. The meteorites of all the respondents—except one—proved to be false alarms. But Dick Umstot, the exception, not only had a garage full of them, he had electronic gadgetry for seeking them out.

The next day Umstot took us on a meteorite hunt about a mile from the crater. After briefing us on the use of metal detectors, he had us scatter about and comb the area for sounds of metal beneath the surface. After only several minutes we found one. Then Umstot, with a few deft sweeps of his detector and several jabs of his knife into the soil, came up with a nice golf ball-sized meteorite. "That's how it's done!" he announced with justifiable pride.

By the day's end, thanks to Umstot, we had several iron meteorite specimens totalling more than 15 pounds. All were fragments of the huge iron meteorite shower that formed the crater near Odessa more than 20,000 years ago. But still we did not have a previously unreported find.

The final recovery investigations of the trip took place near Monahans, some 40 miles southwest of Odessa. Three residents of that area reported possible finds. The first two proved to be false alarms, but Mrs. Jerry Brown, the third and last of the respondents, had what appeared to be a very nice little fragment of an iron meteorite that had been found on the sand hills of eastern New Mexico in 1965.

At first appearance the object did seem to be a meteorite, but final confirmation had to await chemical analysis. A positive test for nickel and cobalt is very important, because these elements are found in specific percentages in all confirmed metallic meteorites. It was a big letdown when a preliminary analysis of Mrs. Brown's "meteorite" revealed no nickel whatever, and a second test confirmed the first—that the specimen contained neither nickel nor cobalt. This specimen was found and not actually seen falling; this fact, together with its chemical deficiencies, means that it cannot be confirmed as a meteorite. But if a fall had actually been observed at the recovery site, it would then present a strong case for an entirely new type of meteorite. Because the Earth has a great variety of shapes and forms for metallic ores and minerals, this report will be recorded as only a very good possibility, not as a bona fide meteorite.



W. E. Hollingsworth, of Plainview, Texas, found this 2.4 pound stone meteorite while plowing in 1938.

Leaving West Texas, we traveled through New Mexico and Arizona, passing out literature to the residents and talking to willing listeners about meteorites. The final stop on the trip was at the great meteor crater in Arizona. For the layman as well as the scientist, this huge pock mark on the Earth's surface is truly an impressive sight. Astronauts trained here, and scientists in assorted disciplines from all over the world have studied its structure. We were pleased to be permitted entry into the crater to examine its unique characteristics and to speculate on the circumstances of its formation.

The field trip to the Southwest is over, but our search for new meteorites continues—as a joint effort of the Field Museum and Harper College. As the trip demonstrated, the future successes of the search will depend to a great extent on public cooperation and willingness to share observations.

Members' Children's Workshops

October 1977

Members' Children (or grandchildren) are invited to participate on Saturdays in October Workshops. The Workshops offer children an opportunity to work with actual specimens and learn scientific and ethnological techniques. The programs for younger children last about one hour, those for older children about one hour and a half.

October 15:

Insects

For ages 9 to 13
Time: 10:30 a.m.
Leader: Betty Deis

Learn where to find insects *in the fall, how to keep them alive during the winter, and how to preserve them for your collection.*

October 15:

African Drums & Stamp Designs

For ages 8 to 10
Time: 10:30 a.m. and 1:00 p.m.
Leader: Natalie Newberger

Be a member of a rhythm band *using authentic African instruments. Make a necklace or sash decorated with Adinkra symbols as your costume.*

Hieroglyphs

For ages 10 to 13
Time: 10:30 a.m. and 1:00 p.m.
Leader: Bob Cantu

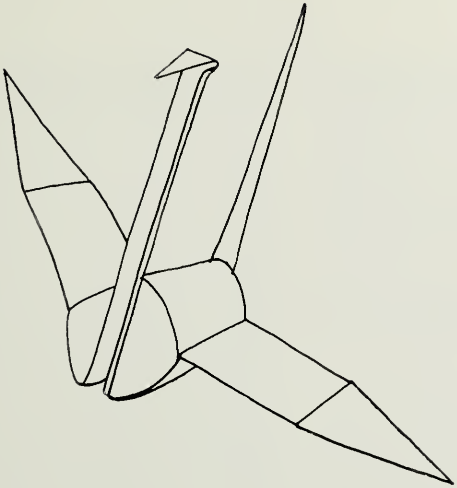
Your name can be written in hieroglyphs. *Learn how to write it and decorate an interesting charm of baked clay which can be used as a necklace.*

October 22:

Dinosaurs to Serpents

For ages 7 to 13
Time: 10:30 a.m. (ages 7-9)
1:00 p.m. (ages 10-13)
Leader: Ann Ross

Learn about a turtle weighing 600 pounds, *a snake 30 feet long, and a lizard that runs on water. Find out about reptiles big and small and how they are related to dinosaurs and other prehistoric reptiles.*



October 22:

The Art of Japanese Paper Folding

For ages 9 to 12
Time: 10:30 a.m. and 1:00 p.m.
Leader: Molly Ozaki

Learn how to make objects, *such as a crane, by folding paper. Also write your name in Japanese characters.*

Chicagoland's Fossils

For ages 7 to 13
Time: 10:30 a.m. (ages 7-9)
1:00 p.m. (ages 10-13)
Leader: Carol Scholl

Explore Chicago's past *by learning how fossils were formed millions of years ago. Take a journey through time by touring the exhibits of Chicago area fossils.*

October 29:

Indians of North America

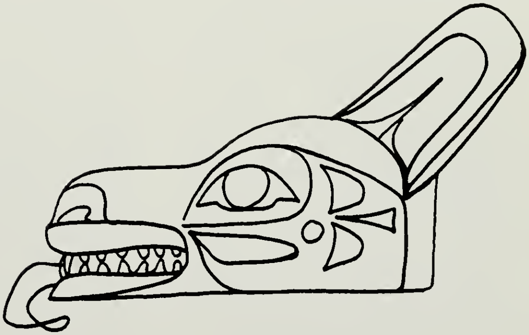
For ages 7 to 12
Time: 10:30 a.m. (ages 7-9)
1:00 p.m. (ages 10-12)
Leader: Delores Dobberstein

Play Indian games *and reproduce Indian toys. See the authentic articles in our Indian halls.*

Masks from around the World

For ages 6 to 9
Time: 10:30 a.m. and 1:00 p.m.
Leader: Jean Vondriska

Children will search *through the exhibit halls to find masks from different cultures. Listen to music and stories from mask ceremonies and make a mask to take home.*



Reservations are necessary and we urge that they be sent in early. The size of each session is limited and applications will be processed in the order they are received. A child can be scheduled into only one program. Please send a separate application for each child in your family who wishes to participate.

Please send coupon or facsimile to:
Children's Workshops
Field Museum
Roosevelt Rd at
Lakeshore Dr
Chicago, Ill. 60605

Application for October Workshops

Program Date
1st choice______________________________
2nd choice______________________________
3rd choice______________________________
4th choice______________________________

Name______________________________
Address______________________________
Membership in name of______________________________

Our Environment

Geckos for Roaches

Tired of those pesky cockroaches on the kitchen counter? Fed up with a cricket-covered carpet? Well, shun that poison like Rachel Greenberg, of Tallahassee, Fla., did, and get after them nature's way—with a tokay gecko.

That may sound strange, but Mrs. Greenberg swears it's true. She says the cockroaches have become quite scarce around her house since she bought four tokay geckos—they're blue-colored Asian lizards with orange spots.

They're very innocuous," she says. "You hardly know they're there. People have come into my house and see them in the corner and gasped. And these were graduate students in biology."

Mrs. Greenberg says she bought the geckos because she was tired of the army of cockroaches that regularly tromps through her house. A friend suggested the little-known Asian lizards and, to Mrs. Greenberg's surprise, her pet store confirmed the claims that the gecko feeds on the bothersome insects.

"They'll even eat small mice," says the sales clerk at the pet store where Mrs. Greenberg got her geckos. "They get pretty big, over a foot in body length."

So, Mrs. Greenberg bought four for $40, but one of them died rather mysteriously soon after she brought it home. "I feel very attached to them," she admits. "The day that one died, I felt very depressed."

But the other three went hard to work. At night.

"They're nocturnal," Mrs. Greenberg says. "They sleep all day and then get up at night. So I haven't seen anybody eating anything. I've never seen any bodies. I don't see any cockroach arms or legs or anything. It's bizarre." However, her son says he saw one the other night, eating away at a cockroach in a rare public display of the gecko's talents.

Anyone planning on getting a tokay gecko should be forewarned that they can bite man as well as eat roaches!

Lightning Detection Device

Each year thousands of acres of land throughout the U.S. are destroyed by fire—many a result of lightning. Some 35 percent of all wildfire on public lands in the 14 western states are caused by lightning, and, according to many estimates, one lightning strike out of ten produces a fire. Typically, a lightning fire is the most costly type of fire and creates the most damage. Because it frequently occurs in remote areas, detection and containment of a lightning fire can be a slow and difficult task. Of course not all wildfires are bad. Like many natural phenomena, fire plays an important role in the dynamic interchange of natural forces. By setting back the stages of succession, in a controlled situation fire can enhance the availability of habitat for wildlife. This trend in thinking is gaining greater and greater acceptance among professional foresters and wildlife biologists who view controlled wildfire as a valuable management tool. The key word, however, is "control."

Bureau of Land Management engineers have recently perfected a sophisticated detection system (LDS) that is expected to play an important role in such control LDS is an offshoot of an earlier research performed by E. P. Krider of the University of Arizona in conjunction with NASA's manned space program. NASA scientists, concerned over an incident in which a manned rocket was struck by lightning prior to launching, provided the initial impetus for the development of a lightning detection system. Encouraged by the findings, BLM researchers carried the project design a step further and modified the detector for use on public lands.

Time is the most critical factor in fire control. While the LDS cannot discriminate between those strikes which start fires and those that do not, it does alert authorities to potential locations. Simply stated, the LDS senses changes in the electromagnetic field produced by large lightning return-stroke currents. A single lightning bolt has both a downward and an upward return stroke. Once activated, the detector unit plots the location of the strike on an x-y coordinate. With intersecting vectors (two or more units), it can pinpoint the location of the strike to within one mile. Although radar is capable of picking up large, moisture-laden thunderstorms, unlike the LDS, it cannot detect "dry" lightning. Since the moisture associated with a thunderstorm is often sufficient to extinguish any fires which might start, these storms rarely present the most severe fire hazard. Dry lightning, however, poses a far more serious and unpredictable threat. Thus the LDS, coupled with radar, can provide a comprehensive detection system.

The system has already been extensively tested in Alaska. In 1976, six operational field units were installed throughout the state, and *all* of the 227 lightning fire starts for the season were accurately computed by one or more of the detection units. This year five more units have been put into operation in what are considered to be some of the most critical fire hazard areas: California, Idaho, Nevada, Oregon and Utah.

Rustlers Steal Trees

If you are one of the fortunate few who have a walnut tree or perhaps a grove of them, be on the lookout for rustlers.

In Iowa, two men were charged with larceny after they allegedly chopped down $30,000 worth of walnut trees and were preparing to sell the lumber.

One of the men operated a tree service and was hired to chop down some trees near Sioux Rapids. But he and an employee also allegedly chopped down 14 nearby walnut trees. The lumber, estimated to be worth at least $30,000 if sold for furniture, was found ready for rail shipment.

Near Chicago, thieves hauled away 20 walnut trees from the Cook County Forest Preserve without detection.

A Pope County, Illinois, farmer discovered walnut stumps left behind in place of his trees, which were appraised at $1,300 per 1,000 board feet.

An Indiana farmer, wakened in the darkness of early morning by his watchdog, found a truckload of his trees, chopped and ready for hauling as the night's work of rustlers. The trees, worth $10,000, were cut a few nights before but thieves couldn't haul them due to thickening mud around their tires.

These people are a new breed of professional criminal, tree rustlers, now illegally harvesting over $2 million in black walnuts annually in Illinois and Indiana alone. And they seem nearly impossible to catch.

A top quality trunk, measuring about 18 inches in diameter with few, if any, notches or marks commands up to $1,900 per 1,000 board feet. A trunk may be worth $4,000.

$80,000 for 18 Walnut Trees

At a recent sale in Ohio 18 black walnut trees, including one the hardwood industry considered the most perfect and valuable black walnut tree in the nation, brought $80,000. When the bidding was over, the new owner of "the perfect tree" put its value alone at $30,000. The tree, called the Bicentennial Tree by its new owner, was between 180 and 200 years old. It measured 57 feet to its first limb and was more than 130 feet tall. Its diameter was 38.4 inches at 4.5 feet above the ground, and its circumference at that height was 10.5 feet.

The big tree will be cut for a yield of approximately 2,000 board feet of walnut. That is enough to cover about 700 livingroom or bedroom suites.

Cactus Rustling in Southwest

Sophisticated rustlers in the nation's Southwest are today going after cacti rather than cattle. Giant saguaro cactus, especially, are highly prized for landscaping purposes. A large crested specimen can bring as much as $1,000. A small potted rainbow cactus sells for $25. Efforts to stop the illegal traffic — some plants are shipped as far away as Japan — are hamstrung in most instances by weak laws and insufficient enforcement.

Arizona recently acted to change all this, however, when it strengthened its laws to require that all individuals either possessing, taking, or transporting native plants from the protected groups (including members of the cactus family) must obtain special permits issued by the state commission of agriculture and horticulture. The permits specify which species of protected native plants may be taken, the area from which they may be taken and the manner in which the plants may be taken. Individuals failing to obtain such permits are in violation of the law and subject to arrest. Other Southwestern states are expected to follow suit.

In the meantime, reports the National Wildlife Foundation, thousands of cacti continue to be rustled annually. The long term environmental impact of illegally removing the stately saguaro cactus and other varieties from their natural setting could be serious.

Critical Habitat Proposed for Houston Toad

Critical habitat has been proposed for the Houston toad, a small and endangered brown frog inhabiting central Texas. Critical habitat designation means that all agencies of the federal government must ensure that none of their actions impinge on the needs of an endangered species.

The Houston toad is among the rarest and most critically endangered amphibians in the United States and has been officially listed as endangered since 1970. Much of the hope for the survival and recovery of this species depends upon the maintenance of suitable, undisturbed habitat. For several years, the Fish and Wildlife Service has recognized the plight of this species and has provided funds for a survey of the remaining populations.

In late 1976, the service received the results of an extensive survey of suitable habitat of central Texas and its resident Houston toads. Four major areas, one in Burleson, one in Bastrop, and two in Harris Counties, were found to contain this secretive, shy species. These areas contain the last remaining habitat and breeding sites for the species; therefore, the Fish and Wildlife Service has decided to propose these areas as critical habitat under Section 7 of the Endangered Species Act of 1973.

The main threat facing the Houston toad is from agricultural and urban expansion, particularly in suburban Houston (Harris County) where two of the major "toad habitats" occur. By declaring critical habitat for all populations, it is hoped that the survival of this unique species will be ensured.

Eastern Timber Wolf Proposed for Threatened List in Minnesota

The eastern timber wolf of Minnesota, a subspecies of the gray wolf, is being proposed for reclassification from the endangered species category to that of a threatened species. This move reflects an increase in numbers, extension of the animal's range in northern Minnesota, and the fact that it is no longer in danger of extinction in that part of its range.

"Endangered" means that a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means that a species is likely to become endangered within the foreseeable future throughout all or a portion of its range.

Numerous attacks on domestic animals have been reported recently in Minnesota as the wolf has extended its range. The reclassification to threatened will allow a limited killing of wolves, when necessary, by authorized state or federal agents, according to the proposal. The wolf population in Minnesota is estimated at about 1,200.

In other states in the "lower 48" outside of Minnesota the gray wolf would continue to be listed as endangered. In Alaska this species is not listed because its population is numerous and healthy in the wild, numbering an estimated 10,000.

Depredating wolves in Minnesota are presently dealt with by live trapping and relocating the culprits. Detailed studies of the relocated animals, however, indicate that once removed from its own territory and relocated onto another wolf pack's turf, the lone newcomer may be subjected to fatal attacks by the resident pack.

The proposal establishes five zones in Minnesota for wolf management, with the first three zones consisting of 9,800 square miles in the northeast proposed as critical habitat. The wolf will be afforded a sanctuary where no killing may occur in its prime range in the 4,412 square miles of zone 1. In the other zones, wolves may be killed if they commit significant depredations on lawfully present domestic animals. Killing may only be done by authorized federal or state employees.

The wolf in Minnesota has been a subject of controversy for the last several years because of its increase in numbers and extension of range to settled areas. On October 4, 1974, the state petitioned the U.S. Fish and Wildlife Service to exclude the wolf from the endangered category.

In response, the service initiated a review on November 21, 1974. Further actions were withheld until the recovery team formulated its plan for the animal. In late 1976 the recovery team — composed of state, federal and academic wolf specialists — recommended reclassification and management. This present proposal is based largely on the recovery team's recommendations.

Status Review of Bobcat and Lynx

The U.S. Fish and Wildlife Service is undertaking a review of the status of two closely related species of North American wild cats: the bobcat (*Lynx rufus*) and the lynx (*Lynx canadensis*). The review will determine whether these species, or any populations thereof, should be proposed for listing as endangered or threatened, in accordance with the Endangered Species Act of 1973.

The bobcat originally occurred throughout the lower 48 states, as well as in southern Canada and northern Mexico. In recent years it reportedly has declined because of habitat loss and excessive killing by man. There has been considerable concern that rapidly rising fur prices may have resulted in widespread depletion of bobcat populations by trappers. The lynx, which still occupies much of Alaska and Canada, has been eliminated from most of its range in the northern part of the lower 48 States.

Bald Eagle Status Report

The people who keep tabs on eagles believe Minnesota has the largest population of bald eagles in the United States, with the exception of Alaska. The U.S. Fish and Wildlife Service annually conducts land and aerial studies of the eagles in the Chippewa and Superior national forests, Voyageurs National Park, state parks and wildlife reserves.

This year's study indicates the Minnesota eagle population is generally stable, says Lee Grim, a seasonal naturalist for Voyageurs National Park. The study is not yet complete but biologists figure the state's eagle population is holding its own and may be up a bit.

There are an estimated 3,000 bald eagles in the lower 48 states, with 600 to 800 of them nesting pairs. The others are nonbreeding adults, generally five years old and younger. The 1976 survey showed Minnesota had 186 "territories" with 121 active nesting pairs. They produced 159 young.

This year the Superior National Forest was found to contain 35 territories, compared with 32 last year, says Karl Siderits, wildlife biologist for the forest. There could be many nests which haven't been discovered in the densely wooded forest. "The eagle population in Minnesota has been very stable in recent years, and is much improved over the 1960s," says Siderits.

At Chippewa National Forest, 106 territories were counted this year, compared with 94 last year. The forest's wildlife biologist, John Mathison, said 10 new nests were found this year, bringing the forest's total to 187. Eighty-three of the nests were occupied by breeding birds, for roughly 78 percent, compared with 71 percent occupancy last year. Mathisen said more eagles are attempting to nest in the Chippewa this year than at any time since record keeping started in 1963. Mathisen, too, believes Minnesota has more eagles than any state except Alaska. One reason why eagles do well in Minnesota, he speculates, is that a better job is done in protecting nest sites than formerly.

Eagle pairs defend their individual territories against other eagles. However, wildlife biologist Jim Stutzman of the U.S. Fish and Wildlife Service at Bemidji says eagles are quick to desert their nests when the territory is disturbed, generally by people. The service monitors nests to prevent activities that threaten the birds, and the area is scouted for hazards to the nest. In many cases a buffer zone is created around the nest sites to help preserve the species from extinction.

Siderits is convinced the future of eagles is on federal and state lands. Elsewhere, he says, there's little concern for the bird and much nest destruction.

The bald eagle is the largest bird of prey in North America except for the California condor. Despite its size of 12 to 14 pounds and wingspan of 80 inches, the bald eagle is not capable of carrying off anything larger than a rabbit. Much of its diet is carrion. The bald eagle is an opportunist that both scavenges and kills its own prey. Eighty to 90 percent of its diet is fish, and the rest is mostly waterfowl. Eagles generally build their nests within one-fourth mile of a lake. Most of the cone-shaped nests are located in Norway and white pine. They weigh several hundred pounds, measuring seven feet across and nine feet deep.

Eagles have a life expectancy of 25 to 30 years and mate for life. The Minnesota birds return early to the northern part of the state, and the female lays one to three eggs early in April and does most of the setting for the next 35 days. For four months the eaglet is entirely dependent on its parents for food. By the time it is 10 to 12 weeks old, it is fully feathered and ready to migrate, usually in September or October. Most northern Minnesota eagles winter along the Missouri and Mississippi River valleys.

Despite a $5,000 fine for killing an eagle, many of the migrating birds are shot each year. The white head and tail feathers which distinguish the American bald eagle don't appear until it is four to five years old. Easily mistaken for a hawk, the young eagle often is shot accidentally.

Outlook Good for Whooping Cranes

Whooping crane production this year has exceeded all expectations and the outlook for this endangered bird, a symbol of America's wildlife conservation effort, has never been brighter.

That's the report from Keith M. Schreiner, associate director of the U.S. Fish and Wildlife Service. Not only is there a record number of whoopers, but possibilities of greater success next year are high.

In all there may be 126 whooping cranes in existence—in the wild and in captivity. Twenty-nine were hatched this spring and, even if half die from weather, predators, accidents, and other causes, 1977 will have been a spectacular year.

The major 69-bird wild flock that summers and breeds in Canada produced 34 eggs, two of which were almost immediately eaten by unknown predators. Sixteen of the remaining eggs were flown to Grays Lake National Wildlife Refuge in Idaho and placed in nests under greater sandhill cranes, cousins of the whoopers.

This effort is part of a joint FWS-Canadian Wildlife Service project to establish a second population of the endangered birds in the wild. So far 12 chicks are known to have survived from the 16 eggs. Of the other whoopers reared by sandhills in this way over the last two years, five are still living.

Of the 16 eggs left in canada, 15 hatched. Eleven of the chicks have survived.

Good news for the whooping crane also has come from FWS's Patuxent Wildlife Research Center at Laurel, Md., where four pairs of whoopers from the 19-bird international captive flocks produced 22 eggs. Last year the flock produced only five.

Eight of these eggs were flown to Grays Lake in May, but were wiped out by a 17½-inch snowstorm that killed two hatched chicks and caused sandhills to abandon the remaining nests. A second batch of six eggs flown out in late May fared much better—three hatched, two didn't hatch and one was eaten by a coyote.

Two other chicks remain at Patuxent, a third died and another egg is being incubated by a pair of sandhills. Two eggs were infertile and one had an early embryo death. The 22nd egg disappeared from a sandhill crane nest at Patuxent, probably either destroyed by an adult or removed by a predator.

FWS biologists expect as many as three other pairs of whoopers at Patuxent to produce eggs in the near future. Four other whoopers, two from Patuxent, are being held for breeding purposes at the San Antonio Zoo and at the International Crane Foundation in Wisconsin. A fifth is at the Audubon Park Zoo in New Orleans.

The final 1977 tally of whooping cranes won't be in until late fall when the Grays Lake flock migrates 800 miles to New Mexico near the Bosque del Apache National Wildlife Refuge and the Canadian flock makes its way south to the Aransas National Wildlife Refuge in Texas, a distance of 2,450 miles.

It's a vulnerable time for the whooping crane chicks and not all are expected to make it. After surviving a brutal winter, they currently face a drought that has lowered marsh water levels at Grays Lake. This has reduced the amount of vegetation and saturated soil where the chicks can forage for insects and other invertebrates and has left them with fewer areas in which to hide from coyotes. Because of this, FWS has stepped up its control efforts at the refuge and 12 coyotes have been killed so far this year.

"Normally a whooper in the wild will lay two eggs, but rarely does more than one chick survive," Schreiner said. "At Patuxent we've taken the eggs away from the whoopers, not only saving the eggs, but also causing the birds to recycle. One pair laid nine eggs this year, so we'll concentrate on producing eggs for the smallest Grays Lake flock in Idaho."

Another plan being considered is to have whooper eggs hatched by sandhills at Patuxent, raised there for a year and then released at Grays Lake when they are stronger and better able to fend for themselves. This would cut down considerably on the tremendous mortality whoopers experience during the first year.

After several years of studying and raising the birds, biologists have overcome a number of obstacles. Probably the biggest breakthrough has been the simulation at Patuxent of conditions in Canada's Northwest Territories where the whoopers naturally breed.

"By extending daylight hours through artificial means, we've managed to simulate the photoperiod of the whoopers' nesting grounds in Canada," Schreiner said. "Starting about Valentine's Day we extend the daylight to 14 hours and then increase it by three per cent weekly until June when daylight is almost 24 hours. This helps them get into breeding condition. Since the birds haven't mated naturally in captivity, an animal physiologist perfected a technique for artificially inseminating the whooping cranes."

Raptor Information Center

In an effort to promote and enhance the study of bald eagles, the National Wildlife Federation, with the aid of a grant from Exxon Corporation, has established the Raptor Information Center in Washington, D.C. The center will assist in the conservation of bald eagles and other raptor species by: (1) identifying and protecting critical bald eagle habitat; (2) increasing communications and acting as a "clearing-house" for relevant literature and; (3) identifying and encouraging the support of priority bald eagle research including annual censusing. Specifically, the center will work actively with the public, scientists, and agency and National Wildlife Federation personnel to identify key bald eagle habitat areas and make arrangements for their purchase or protection through landowner agreements.

The center intends to develop a computerized system of information sources and to generate a bald eagle bibliography. Initially emphasizing the bald eagle, the center will also create a computer-based service to answer such questions as "Who's doing what?" and "Where are the data?"

September and October at Field Museum

(September 15 to October 15)

New Exhibits

Pawnee Earth Lodge—opens October 15. Field Museum's newest permanent exhibit is a full-size replica of a traditional Pawnee earth lodge. The circular lodge, symbolic of the universe, is constructed of cottonwood tree trunks with willow lath, prairie grass, and dyed plaster. The interior is furnished with traditional buffalo robe-covered beds. Clothing, tools, weapons, and trade store items are placed as the Pawnee stored them—under beds, against wall posts, and suspended from the ceiling. The Pawnee earth lodge exhibit was partially funded by grants from the National Endowment for the Arts and the National Endowment for the Humanities. Hall 5, main floor.

Exotic Fliers: Portraits of Neotropical Birds. An exhibit of exquisite bird illustrations appearing in the recently published *Manual of Neotropical Birds* (University of Chicago Press), Vol. 1, by Emmet R. Blake, emeritus curator of birds. Hall K, ground floor.

New Programs

On Your Own. Adult- and family-oriented self-guided tour booklets are available, for 25 cents, at the entrance to the Museum Shop, main floor north. Adult series: *Animals in Egyptian Mythology, The Iroquois: Culture in Transition*, and *China in the Ch'ing Dynasty*. Family series: *Friend or Foe?, The Artist's Zoo, Chicago: My Kind of Town*, and *Tibet: Nomads of the Mystic Mountains*.

Autumn Journey: Cook's Tour. Self-guided tour leads children through the museum's exhibits of Plains Indians, Woodland Indians, and Indians of California to learn about their food, cooking utensils, recipes, and food preparation. Free *Journey* pamphlets are available at the information booths, main floor.

Ayer Film/Lecture Series—begins October 1. Each Saturday, at 2:30 p.m., sit back and enjoy a ninety-minute adventure in a remote or familiar area of the world. These beautifully produced films are personally narrated by their film makers. Reserved seating is available for members and their families. Doors open at 1:45 p.m. Simpson Theatre, ground floor west.

October 1 *Switzerland Today* by Willis Butler

October 8 *Colorado* by Frank Nichols

October 15 *Northwestern Adventure: Idaho, Oregon, Washington* by Dennis Cooper

The Ancient Art of Weaving—resumes October 3. Weaving and spinning demonstrations every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

Continuing

The Place for Wonder. This gallery provides a place to feel, handle, sort, and compare natural history artifacts and specimens. Trained volunteers are on hand to help guide in exploration. Open weekdays, 1 p.m. to 3 p.m.; weekends; 10 a.m. to noon and 1 p.m. to 4 p.m. Ground floor, near the new cafeteria.

Man in His Environment. This exhibit offers a worldwide perspective of environmental problems. It asks you to consider our present realities and future possibilities. Hall 18, main floor.

Weekend Discovery Programs. Guided tours, demonstrations, and participatory museum-related activities. An educational and entertaining way to spend part of a weekend. Saturdays and Sundays, 10 a.m. to 3 p.m.

Male and Female: Anthropology Game. The exhibit where visitors become anthropologists. Examine 38 artifacts, decide which were used by men, by women, or by both sexes. Discover that economic and social roles of the sexes are not universally the same. Ground floor, near the elevator.

Special-Interest Meetings Open to the Public

Sept. 1, 7:00 p.m.	The Primitive Arts Society
Sept. 2, 8:00 p.m.	Chicago Anthropological Society
Sept. 6, 7:30 p.m.	Kennicott Club
Sept. 8, 8:00 p.m.	Chicago Mountaineering Club
Sept. 11, 2:00 p.m.	Chicago Shell Club
Sept. 13, 7:30 p.m.	Chicago Nature Camera Club
Sept. 14, 7:00 p.m.	Chicago Ornithological Society
Sept. 14, 7:30 p.m.	Windy City Grotto, National Speleological Society
Sept. 20, 7:30 p.m.	Chicago Audubon Society

September and October Hours

The Museum Opens daily at 9 a.m. and closes at 5 p.m. every day except Fridays. On Fridays, year-round, the museum is open to 9 p.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday. Obtain pass at reception desk, main floor north.

Museum Telephone: (312) 922-9410.

October
1977

Field Museum of Natural History Bulletin

Field Museum of Natural History Bulletin

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Field Museum of Natural History

Founded 1893

President and Director: **E. Leland Webber**

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CONTENTS

3 **Field Briefs**

6 **Kimberley Snail Hunt—Rounds II through IV**
Searching for Land Snails in Western Australia
By Alan Solem, curator of invertebrates

10 **Père David's Deer**
The Species that vanished from its natural habitat 3,000 years ago
By Dale J. Osborn, research associate

14 **In the Daze of Good King Tut**
By Florence Johnson

15 **Tut in Retrospect**

16 **Egypt Tours for Members**

18 **Native Americans through the Camera Lens of Charles H. Carpenter**
Photos taken at the St. Louis Exposition of 1904
By Alan Koss

24 **The Pawnee Earth Lodge**
Replica opens to public October 15

26 **Edward E. Ayer Film Lecture Series**

27 **October and November at Field Museum**
Calendar of coming events

The editor gratefully acknowledges the editorial assistance of Hermann C. Bowersox, a Field Museum volunteer, in the preparation of this issue.

COVER

Door County, Wisconsin, shoreline in October. Photo by John Kolar.

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Field Briefs

Riccardo Levi-Setti

"Uniguide," Portable Audio Guide Now Available

The museum's newly installed audio system, Uniguide, enables visitors of all ages to visit up to 50 selected exhibits in any sequence they choose. Complete with background music, sound effects, and factual information supplied by the museum's scientific and education staff, this system provides an entertaining as well as educational experience. Specially designed audio receivers and maps are available for a nominal fee at the entrance to the Museum Shop, main floor north.

Dave Walsten

Nika Semkoff Levi-Setti, public relations, and Matteo Levi-Setti test Uniguide headsets at Uniguide's new counter on the main floor.

Governor Thompson Signs Bills Benefitting Museums

Illinois Governor James R. Thompson, center, is shown on August 13 at Field Museum after signing into law Senate Bill 557 and House Bill 1458. The bills are designed to promote and preserve Illinois' cultural heritage through the purchase of artwork for public buildings and by providing additional monies for museums located on Chicago Park District land. Shown with the governor are Victor Danilov (left), president of the Museum of Science and Industry, and E. Leland Webber, president of Field Museum.

Senate Bill 557 provides funds for the purchase of artwork for public buildings constructed or renovated beginning in fiscal year 1979. It stipulates that half of one percent of construction or reconstruction funds will be used for purchasing art by Illinois artists for the buildings.

House Bill 1458 allows the Chicago Park District to levy a maximum tax of 9 percent of the full fair cash value of property within the Chicago Park District. The tax will be used for constructing, operating, and maintaining museums and aquariums on park district land. The current levy is 6.5 percent. It is estimated that the legislation could provide up to $2.5 million in new monies.

Phillip Lewis

David Lasisi, then called Galip, in his mother's arms. Photo taken in 1954, when David was about one week old.

A Visitor from New Ireland

Last July, a young man from Lossu, in New Ireland, visited Field Museum, partly to see me, partly to see the collection from his home culture. Lossu is the village I have studied, in 1953-54 and 1970, and David Lasisi is the first person from that village to come to Chicago. Over the years I have daydreamed about possible visitors from Lossu, wondering who it would be, a political figure, a teacher, someone coming to study at an American university. It turned out that David is an artist, a printmaker, poet, and actor, but primarily a sculptor. Because I have been studying the art of New Ireland, I was delighted that the first Lossu visitor was an artist.

He is a contemporary artist, and has had several commissions: sculptures for the Papua New Guinea Banking Corporation in Port Moresby, for the University of Technology at Lae, and a mural for the Indonesian Embassy at Port Moresby. His latest work is a series of large sculptures outside the new museum in Port Moresby. David's visit to the U.S.A. was as a participant in the International Visitor Program, sponsored by the Bureau of Cultural and Educational Affairs, U.S. Department of State.

The last time I saw David, prior to his July visit, was in March, 1954, when he was only a week old. I took the photo of him (shown here), in his mother's arms, in a maternity hospital on the east coast of New Ireland. My wife Sally and I were on the way to Kavieng, the administrative town, and had stopped to say goodbye to two young women who had given birth to two new Lossuans, one of whom was David.

At that time, David Lasisi bore neither of those two names, but was called Galip, after a nut much favored by New Irelanders. Later, Galip was named David when he was christened as a Methodist. The name Lasisi is that of a *malanggan* carving, and taken by him in later years as he became interested in this major art form of his culture.

Phillip Lewis, Chairman of the Department of Anthropology, and Field Museum visitor David Lasisi, artist from Lossu, New Ireland. They are holding a malanggan *carving from New Ireland. Each of the four heads on the 70-year-old carving represents a deceased person who was honored in the ceremony for which the carving was made.*

Dave Walsten

Malanggan is the name given to the splendid carved and painted sculpture made and used for certain memorial ceremonials, also called *malanggan.*

When I first heard that a Lossuan was coming to Chicago, and his name was David Lasisi, I didn't know who he was! I checked the census and genealogies compiled by me in 1953-54, and 1970, when I was last in Lossu. It was only when David Lasisi finally arrived in person that I was able to place him on my genealogies. He turned out to be Galip, the second child of Judas and Rakel, and was a member of the Sakwila clan. I even found a note penned in red ink in 1970 "David, away at Rabaul." Thus, I had not met him in 1970, when he was a teenager away at school, and not living in Lossu.

When he did arrive at the Museum, we talked about much in the two days he was here; he saw our New Ireland collection, and I promised to send him an enlarged photograph of his father, Judas, who had died recently, so that David can make a tombstone with his father's image sculptured in cement. I was very pleased to see that he had developed into an articulate, vital young man. His government and the former Australian territorial government are to be congratulated for educating him, and our own government, too, deserves credit for making possible his trip to the United States. Especially noteworthy is the fact that he has been encouraged to be an artist, who may carry on his country's fantastic artistic achievements and to strike out into new paths of art.

— Phillip Lewis
Chairman,
Department of Anthropology

Freeman Joins Mammals Staff

Patricia W. Freeman has been named assistant curator of mammals. Prior to her Field Museum appointment, Dr. Freeman was a scientific assistant at the American Museum of Natural History, New York. She obtained her doctorate earlier this year from the University of New Mexico, where her research included evolution in bats.

Members' Nights for Spring, 1978

Field Museum's traditional Members' Nights, originally scheduled for October 6 and 7, have been postponed to spring, 1978. The postponement is deemed necessary because many of the areas in the curatorial departments will be in the midst of renovation, making the accommodation of large numbers of visitors difficult or impossible. However, by spring of next year enough of the renovation work will be completed so that the customarily large Members' Night crowds will be able to visit all areas.

Gamelan Is Coming to Town!

Restoration of the Museum's Sundanese (West Javanese) *gamelan* is nearing completion. the gamelan is an ensemble of 23 musical instruments consisting of bronze and wood sounding parts supported by polychrome sculpture frames. The Museum's gamelan was performed in daily concerts during the World's Columbian Exposition of 1893 and is part of the third group of anthropological artifacts to be accessioned by the Museum when it was first organized.

Field Museum's gamelan appears to be the oldest—about 130 years old—and one of the finest complete gamelan outside of Java. It is the only known gamelan in which the sculptures represent the total view of the Javanese concept of the cosmos. This same ensemble was recorded during the 1893 exposition on 33 wax cylinders. These have been preserved and are now in the Library of Congress.

As soon as the restoration and light tuning of the instruments have been finished, and additional instruments arrive from Java, the gamelan will be played in concert and placed on display.

A troup from Sunda will perform on some of the instruments in James Simpson Theatre in November (exact dates to be announced). Educational programs will include the instructing of local musicians and music students, with a debut performance of the entire 23-instrument gamelan scheduled for January.

Louis Pomerantz, internationally known art conservator, is responsible for the artistic and structural restoration of the instruments. Ernst Heins, of Amsterdam, an ethnomusicologist and renowned gamelan expert, is special external adviser. Sue Carter-De Vale, an ethnomusicologist and professional harpist (whose doctoral dissertation was on Field Museum's gamelan), is program and research director. Bennet Bronson, Field Museum's associate curator of Asian archaeology and ethnology, is project director.

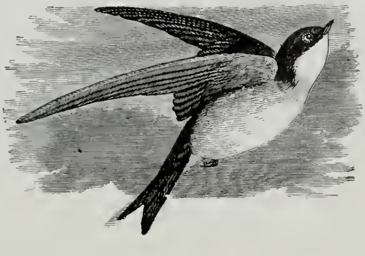
Richard Leakey to Speak

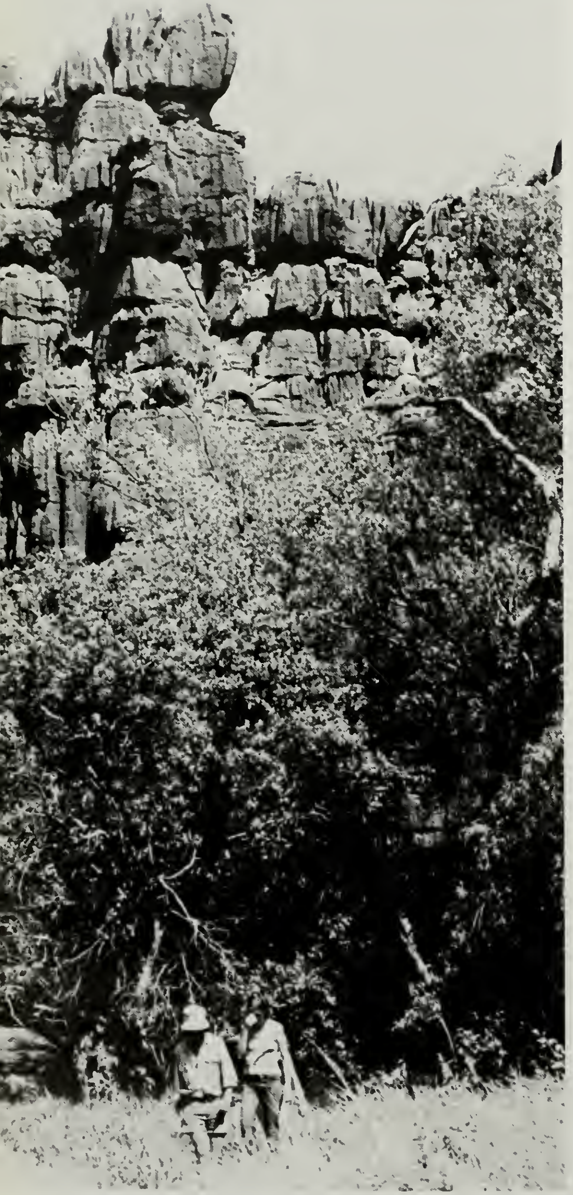
Noted anthropologist-paleontologist Richard E. Leakey will give an illustrated lecture at Field Museum on Friday, Oct. 28, at 7:30 p.m. in James Simpson Theatre. He will also autograph copies of his *Origins*, coauthored with Roger Lewin and published in October by E. P. Dutton.

Leakey is director of the National Museums of Kenya and the son of famed anthropologists Louis and Mary Leakey. He has continued his parents' pioneering field work in East Africa; in 1972 his team unearthed fossil "1470," the oldest complete skull of early man, which is credited with pushing back humankind's known origins some two million years.

His excavations at Lake Turkana in northern Kenya suggest that perhaps three or even more species of primitive hominids existed simultaneously in the same geographic region millions of years ago. Why "our" line—*Homo*—survived while others vanished is the central question of Leakey's and Lewin's new *Origins*.

The book was recently awarded the "Man in His Environment Book Award," created to stimulate the writing of good books on ecological themes for a popular readership. *Origins* is available at the Museum Shops; $17.95, 10 percent discount for members.





Alan Solem

In the Napier Range, in March, after regeneration during wet season.

KIMBERLEY SNAIL HUNT

Rounds II through IV

By Alan Solem

A favorite saying of a distinguished former chief curator of zoology at Field Museum, Wilfred H. Osgood, was "No zoologist should ever go anywhere for the first time." He meant that you went with preconceptions. Your first visit involved getting reoriented, shedding ideas, finding new ones, and generally learning how to operate effectively. By the end of your first visit you *think* you know what you are doing. Then, back at the Museum, when you study the specimens, you receive all kinds of surprises. Only then do you *know* what you should have been doing in the field from the beginning and you would give a great deal to "do it over again." Unfortunately, usually you can't.

This saying came to my mind time and time again as from January through April, I dissected, measured, identified, classified, and described many of the land snail species I had collected in the Kimberley from September to Christmas of last year. Because of my 1974 collecting in the Pilbara Region of Western Australia, I could and did operate effectively in survey collecting through the Kimberley, but actual study produced a great many surprises. Snails collected under the same rocks and logs that in the field had looked alike to all malacologists who visited the Mitchell Plateau (myself, Barry Wilson, Fred Wells, Laurie Price, Shirley Slack-Smith, and Carl Christensen) turned out to differ widely in anatomy and to belong to distinct species; what looked in the field like a series of variable species along the Ningbing Range turned out to include three very distinct

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Alan Solem is curator of invertebrates. His "Kimberley Snail Hunt — Round I" appeared in the March, 1977, Bulletin.

A slope in the Napier Range, in October, after being burned.

Alan Solem

genera that showed complex convergences in shell structure; and patterns of variation in anatomy proved far more complex than had been anticipated.

The success of "Round Two" in Perth (museum study) was in large measure due to illustrator Elizabeth Liebman, whose sharp eye and skilled hands could translate my dissections into two-dimensional drawings, retaining essentials of structure and presenting contrasts and comparisons far better than camera or words could hope to achieve. Always present in my mind was the knowledge that "Round Three"—wet season field work on the fringes of the Kimberley—was proceeding, and that "Round Four"— a last session in the field—had to be planned for and activated. About 40 species, of the perhaps 125 total, were measured, dissected, illustrated, and preliminary descriptions typed and edited while in Perth.

A stream of letters to Carl Christensen, graduate student from the University of Arizona, and Laurie Price, field associate of Field Museum from Kaitaia, New Zealand, suggested problems, asked for specimens, forwarded data, and hoped for news of rain. Situated at Napier Downs Station, about 100 miles east of Derby, they were attempting to find out how the many snails of the Napier Range behaved once the rains came and they could enter this season of activity.

My collecting had been, of necessity, in the late dry season. Live snails could be found sealed to rocks or buried in soil, sitting and waiting for the rains to come. The late start of the rains meant that we could get about and into areas for snail "prospecting," but there were disadvantages. As a collector, I could obtain live specimens unless the annual burning of the vegetation had fried all live snails within rock pile excavation limits. But these snails were sitting, waiting for rains to come. What would they feed on? How quickly would they activate? When would they mate? How quickly would eggs be laid? When would young appear? How often would they be active? How fast would they grow? In short, how they would go about the ordinary processes of living, once rains gave them the opportunity to be active. As a biologist, I needed a different set of data.

So a team of malacologists joined a team of mammalogists, Laurel Keller (technical assistant at Field Museum) and Roger Buick (technical assistant at Western Australian Museum), for the wet season at Napier Downs. And here we had a classic demonstration of the capricious nature and unpredictability of weather in a semiarid climate. The rains came late, lightly, and only touched small areas at first. Just as I was packing to leave the Kimberley before Christmas, a line squall dumped a half-inch of rain on part of a slope. In October and the day before, I had spent a total of 8 fruitless hours in search for live specimens of one species. Within 20 minutes after the rain stopped, 50 snails could be seen crawling on the rock faces where the rain had penetrated the deep crevices into which they had retreated months before. Where the driving rain had not hit rock faces, no snails were seen.

Often the wet season begins with a two-to-four-inch soaking, but in 1976-77, such rains did not come to the Napier Range until February, a record late arrival. The short, wind-driven showers had activated small parts of the populations piecemeal, and detection of overall patterns of activity was more than difficult.

Matching the late rains in the Kimberley, was a total lack of rain near Perth and in the southwest part of Western Australia. I had planned opportunistic field work in this region as rains came, and was chagrined to find Perth enter and complete its driest summer in 72 years. No rain fell in Perth between mid-December and May 1, for a new record of dryness. Nice for beach activities, but hard on crops and devastating to snails. Areas sampled in 1974 were revisited, with twice the field time producing a quarter of the live specimens.

Meanwhile, dissections of snails collected in October had revealed a complex and interesting series of variations in species from the Mitchell Plateau, a mountain of bauxite scheduled to be developed by AMAX Corporation. A comprehensive survey of this area by staff of the Western Australian Museum and Field Museum had yielded very important late dry season data. What were the snails and mammals doing reproductively in the late wet season? Nobody knew. So Darryl Kitchener, curator of mammals at the Western Australian Museum, and I proposed a short wet season survey, involving three mammalogists and three malacologists. Generous support in the form of transportation, vehicle use on the Mitchell Plateau, housing, and "tucker" (Australian slang for "food") was provided by AMAX Corporation.

So early in March, two Western Australian Museum mammalogists and I flew north, joining Laurel Keller and the two student malacologists in Derby. We then received object lessons in the power of wet season weather. Cyclone Karen battered first the coast near the Mitchell Plateau, then the coast far south of Derby. The plane that was to fly us into the Mitchell Plateau was stranded by high winds 1,000 miles south for two days. At last the plane arrived, our gear was loaded, and then news came that the airstrip at the Mitchell Plateau was washed out and we couldn't go. Five days later, we did get five people into the Mitchell Plateau. They enjoyed excellent collecting, and then were stranded on the Mitchell Plateau for four days by Cyclone Leo. The mammalogists flew to Perth, but the two malacologists were to drive a landrover south, sampling snail populations on their way. After five months in the bush, the thought of a return to civilization was more than enticing. Unfortunately,

"The success of "Round Two" in Perth . . . was in large measure due to illustrator Elizabeth Liebman, whose sharp eye and skilled hands could translate my dissections into two-dimensional drawings."

Dave Walsten

Sunset on Ayers Rock, Central Australia

Alan Solem

Cyclone Leo had turned a 100-yard river into a raging five-mile wide torrent, washing out both highway and railroad bridges on March 24. It was April 7 before approaches to the railroad bridge could be repaired, allowing the landrover to start south. Excellent collections resulted from the wet season activity, but clearly Round Three was thoroughly controlled by the weather.

Meanwhile the drought continued in the south, and dissections revealed more and more interesting things in the Kimberley. Originally I had planned to collect along the south coast and across the Nullarbor, then go up to Alice Springs and join colleagues from Melbourne, Victoria, and Mt. Gambier, South Australia, for the last segment of field work in Australia. But the severe drought conditions meant that mostly I would be collecting dead shells on the way. To drive to Alice Springs via the Kimberley would add only 1,500 kilometers, permit revisiting many populations and getting early dry season samples (What was the reproductive condition of adults? Were there size classes of juveniles? Where were they sheltering? Was food stored undigested in the stomach? and many other questions), plus get further into the Ningbing and associated areas. This seemed scientifically far more profitable.

Early in May, collections to date and gear were packed for shipment from Perth to Chicago, illustrator Elizabeth Liebman was left with mounds of drawings to complete, and a reduced field team of Laurel Keller, myself, and a whippet puppy named "Lucky" headed north on "Round Four." From the harsh burned landscape of the dry season to the lush green just after the wet season was a shocking contrast visually. Snails were incredibly abundant near the surface of rock piles, and sampling from known colonies was quickly completed. A few hectic days in the Ningbing Range, a dash through the Tenami Desert to Alice Springs, then 10 days of collecting between Alice Springs and Ayers Rock. My last field station in Australia was at Mt. Olga in the late afternoon —yet another new species—and finally the spectacular view of sunset on Ayers Rock. A grueling four-day drive to Melbourne (5 flat tires, 2 completely wrecked), packing, two hectic weeks of study at museums in Melbourne and Sydney, and then the Australian Field Program was finished.

As I write this, the joint shipment of gear from Perth, 65 cases of mollusk, mammal, insect, and fossil mammal specimens has just arrived at Field Museum and cleared customs. It now can be unpacked and study resumed. Ideas are fermenting, manuscript accumulating, and the impressions and knowledge gained through months in the field will be tested in the lab over the next two years. And then back to the field, to areas that time limits prevented visiting, to places not visited because of drought, and to test out new theories gained from the studies under way. For knowledge is cumulative and the questions raised will outnumber those answered.

PÈRE DAVID'S DEER

By Dale J. Osborn

A record not to be found in the *Guinness Book of Records* but remarkable, nonetheless, is that of Père David's deer: the animal has survived in captivity for more than 3,000 years, having died out in its natural habitat—the swamps of northern China—during the Shang dynasty (1766-1122 B.C.). This extirpation of the species occurred when the lowlands were drained and converted to productive crop land; it may well be the first known instance of such destruction by man.

Fortunately, the species was perpetuated on the private, enclosed grounds of an imperial park not far from Peking. There was plenty of room for them in the park, as it was some 40 miles in circumference, all enclosed by a high wall, built about A.D. 1400.

The first Westerner known to have seen the deer was Père Jean Pierre Armand David (1826-1900), a French Lazarist missionary who collected thousands of zoological and botanical specimens during his years in the Orient. Of special note were his discovery of the giant panda and the Roxellana, or snow, monkey, both of which he found in Szechuan Province.

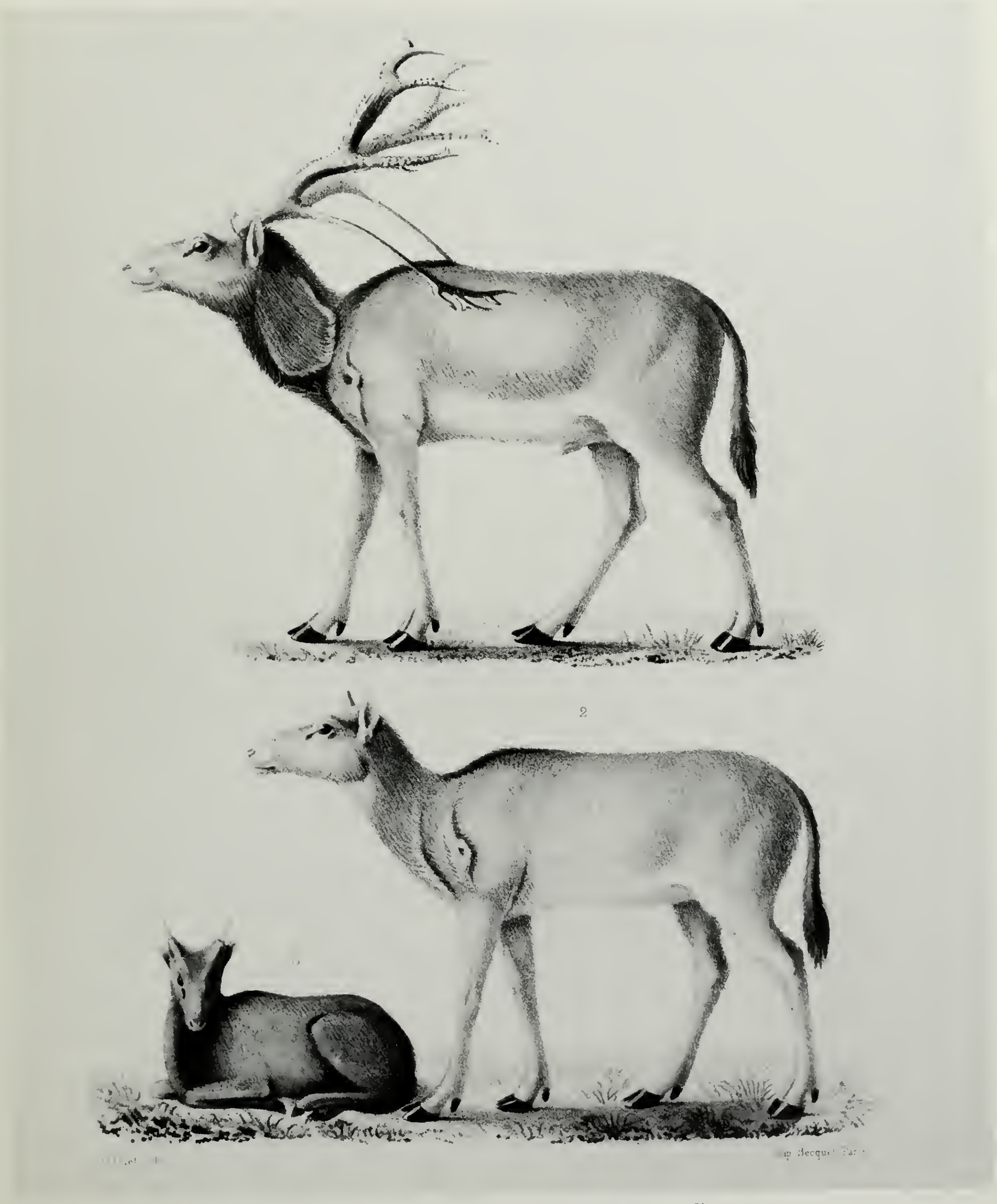
One day in 1866, Père David peered over the imperial park wall—its grounds being strictly off limits to foreigners—to see a large herd of "gentle animals with a foolish expression, . . . the feet of a camel, and the elongated tail of certain antelopes," he wrote in his diary. "The Pekinese call it *ssu-pu-hsiang*—'four dissimilarities.' "

So eager was Père David to obtain specimens of the *ssu-pu-hsiang* (also called *milu* in Chinese) that he, or his intermediaries, bribed guards into smuggling the skin and bones of two carcasses out of the park, knowing that the guards were not loathe to do a bit of poaching for themselves. He sent the remains to the Paris Academy of Science, where French naturalist Alphonse Milne Edwards noted that the animal's features were closer to

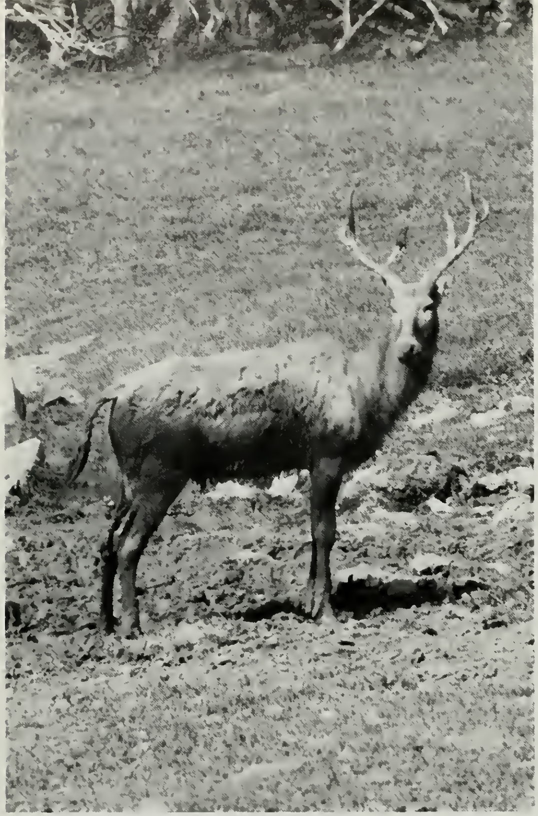
L. LaFrance, courtesy Brookfield Zoo

The eleventh duke of Bedford, who may well be credited with saving the Père David's deer from extinction, described them as having "a solemn and somewhat meloncholy expression."

Dale J. Osborn is curator of special projects at Brookfield Zoo.



Père David's deer as shown in Alphonse Milne Edwards original paper on the species (1866).



D. D. Norkey

Full grown male Père David's deer are about 48 inches high at the shoulder and weigh more than 400 lbs.

those of the European red deer (elk, or wapiti, in North America) than to those of the reindeer. He wrote that its coat resembled the reindeer's, but its nose and skull were more like the deer's. It differed from the latter, however, in the branching of the antlers and the length of the tail. He named it *Elaphurus davidianus*, after the priest. It comprised a new genus as well as a new species.

Shortly after Père David secured the skin and bones he was able to get three live animals through the offices of the French chargé d'affaires. These were kept on the embassy grounds for nearly two years, then shipped to the London Zoological Society. They died en route, however.

In August 1869, thanks to Peking's British legation, another young pair of deer was secured, and these managed to survive the long journey to England. During the next year or so the French and British shipped enough additional animals to stock several British and European zoos. The small groups continued to breed often enough to just about maintain themselves.

Some years after Père David's discovery, two catastrophes nearly wiped out the large imperial park herd. In 1894 a severe flood caused the collapse of a section of the park wall and most of the deer escaped, only to be killed by local peasants. Six years later, during the Boxer Rebellion, the few deer remaining in the park were nearly exterminated by British soldiers who broke into the park and machinegunned the herd to prevent the Chinese insurgents from using them for food. The survivors of this slaughter were taken to Peking where the last one died in 1921.

In 1900 the eleventh duke of Bedford, recognizing the plight of the Père David's deer, requested that European zoos send their breeding stock to the 3,000-acre Woburn Abbey Park, in England. The zoos responded warmly and a herd of 16 to 18 was acquired. This was the first known instance of zoos cooperating to save an endangered species.

During World War I the species again had a close brush with extinction when starvation and a disease of the intestinal wall nearly wiped out the Woburn herd. Later the disease became so prevalent in a herd of Japanese sika deer in the park that they were destroyed to prevent reinfecting the Père David's.

By 1922 the Woburn herd, having recovered, numbered 47 adults, plus 17 fawns born in that year alone. In 1935 the herd had increased to more than 200. The deer showed no ill effects from intensive inbreeding, with the possible exception of two albinos.

In 1945 the twelfth duke of Bedford decided that herds should be established elsewhere in order to minimize the danger of epidemics. Two male calves were sent to Whipsnade, a spacious enclosure belonging to the London Zoological Society. The following year two female calves joined them, and in 1947 one of them gave birth to the first Père David deer born outside Woburn in nearly 50 years.

In 1956 the London Zoo sent four specimens to a place near the origin of their ancestors: the Peking Zoo. Surplus animals were regularly sent to other zoos and by 1963 the world population of the species was about 400. Today there are more than 700. Virtually every major zoo in the world has a small herd, and the deer is found in such far-flung places as Edmonton, Alberta; Lago Hermoso, Argentina; Pretoria, South Africa; and Melbourne and Sydney, Australia. The first Père David's deer to arrive in this country came from Woburn to the Bronx Zoo in 1946. Brookfield Zoo, near Chicago, acquired its first pair from Woburn in 1950 and now has 13.

The Chinese name, "four dissimilarities," is totally apt, for many features of Père David's deer differ from those of even its closest relatives. The deer lacks a white rump patch and is the only species with a long tail tuft; in Père David's it may reach the hocks. The antlers are unique in that they appear to be set backwards on the head. The hoofs are large and spreading, and the dewclaws—the first digits on the hind feet—are exceptionally large, an adaptation to the animal's original marshy habitat. Such large spreading hoofs also occur in other swamp dwellers—the barasingha, or swamp deer, of India and the sitatunga, or swamp buck, of Africa—as well as in the reindeer. In comparison with the elk and red deer, Père David's has small ears, a narrower and more elongate head, and a straighter profile. The face was described by the eleventh duke of Bedford as having "a solomn and somewhat melancholy expression which is enhanced by the Père David's habit of spending long periods just standing about doing nothing in particular."

The call of a rutting Père David's stag is not like the "roar" of a red deer stag, but rather a "bray." The animal is also more prone to "bark" when alarmed. Early in the rut, before the velvet peels from the antlers, males may fight with their teeth; they will also rear onto the hind legs, "boxing" with the forefeet like red deer. The two species also share the habit of wallowing. Antlered Père David's use the long back tines for digging. By turning the head sideways and digging downward, they scoop up mud and deposit it on their backs.

Unlike the red deer, Père David's seek shade in summer, feed on reeds and other water plants, wade into lakes, and swim in deep water. In this respect they are even more aquatic than the Chinese water deer.

The gait of Père David's is a stiff-legged creep reminiscent of that of the African swamp buck. One observer described it as "slow and stately," and called the deer's faster gait a "lolloping trot." The peculiarities of the deer's locomotion is further emphasized by a "crackling" of the hoofs, as in giraffes and reindeer.

The comments of zoo visitors, on seeing these deer for the first time, are about as complimentary as those in the priest's own diary or the descriptions of the duke of Bedford: "What funny-looking deer!" "Why do they walk so slowly?" "They walk like their feet hurt." "Look at that one covered with mud. Ugh!"

The fate of the *ssu-pu-hsiang* has also become the fate of many more wild animals. Hundreds of species are on the brink of extinction as the result of being crowded into smaller and smaller areas. This of course is the consequence of man's constantly expanding his own living area and his ever-increasing demand for more crop land, more space for grazing domestic animals and timber-productive forests.

A close relative of Père David's deer, the Formosan deer, has also died out in its natural habitat but survives in captivity. Przewalski's horse, found in zoos, is close to extinction in the wild. Zoos have been instrumental in the restoration of the European bison, or wisent, in the forests of Poland. Our own North American bison, close to extinction at the start of this century, has also been restored to a healthy status on national parks and ranges. But there is a limit to man's capacity to restore and to accommodate the special needs of the very animals that he has pushed so close to extinction.

Père David's fawns are spotted like the fawns of other deer and elk.

Courtesy Brookfield Zoo

In the Daze of the

By Florence Johnson

Dateline: Chicago. "King Tut's Exhibit set an oddball record at the Field Museum. Anyone who got in line after 5 a.m. Tuesday didn't get to see Tutsville that day."

It was 4:30 a.m. — two days earlier — when we got in line. Amber arch lamps lighted the expressway through the sleeping city as we made our way from suburban Arlington Heights to the trafficked loop downtown. It seemed ridiculous to be wandering around the big city at such an unearthly hour but we had only one purpose in mind when we decided to spend the weekend in Chicago: to see the Treasures of Tutankhamun, regardless of the cost. If, as the ads said, this was the exhibit we had been waiting for since 1325 B.C., then what difference would it make what time we started out or if we had any sleep at all?

Word had it that those arriving by 7 a.m. were not getting in although the doors would not be open for another two hours. Only a week remained for the showing in Chicago, and it would take nothing less than dogged endurance to get in. Yet, as we neared the parking area, the thought crossed our minds that such an early venture might be completely uncalled for. How many, like us, would actually line up for an ancient Egyptian exhibit in the wee morning hours?

But, to our amazement, there they were in startling relief beneath the marbled Corinthian columns of the Field Museum — row upon row of covered bodies sprawled on the ground, encased in sleeping bags, snuggled in quilts, slumped in folding lawn chairs, hidden under plastic tents. Other shadowy figures paced aimlessly, being careful that no one would usurp their squatter's rights.

Parking lots were jammed. Hordes of people emerged from cars, carrying armloads of outdoor gear and bleary-eyed children dragged from their beds. In the mass confusion surrounding the museum, it was difficult to determine where one line ended and another began. Clearly, two lines descended each stairway at the north and south doors but then merged somewhere together on the east and west sides of the building. So it seemed wise to ask a policeman where we should go. "If I were you," he advised, "I'd go home. More people are already around here than can possibly get in." But we couldn't turn back, not at 4:30 a.m. (In the back of our minds, however, was an alternate plan. If we didn't make it on Sunday, there would be Monday to try again.)

Walking a block to the east, half a block north and another half block toward the building, we finally found an end to a line and unloaded our stuff on the ground. Twenty feet away from us were a dozen portable toilets which had been specially installed for the waiting crowds. Incessant banging of the doors sounded like the volley of a gun. Within an hour, lines were forming even to get into the johns.

Camaraderie developed as people melded into groups. Our immediate circle included two young women with an unending supply of bologna sandwiches, a couple from India in light clothing who expected the day to be hot, and a smiling middle-aged couple who observed the passing scene from folding chairs and said nary a word.

Stretching out under the trees, we occupied ourselves with people-watching and scanning the horizon for signs of the sun. Chilly air swept inland from Lake Michigan while occasional flashes of lightning signaled an approaching storm. As we looked around, we couldn't help ask ourselves what we were doing out here at 5 a.m.! Rain pattered on the leaves and dripped indiscriminately on cowering bodies below. Now we knew how hippies must feel, sprawled on the ground in damp, dusty clothes. But we, at least, had a hot thermos of coffee and cinnamon rolls to help keep us warm.

Shivering in the cold, the lady from India pulled her cotton sari tighter around her body and arms. "Would you like some coffee?" we asked. But she politely refused. "I'd hate to have to use one of those awful stalls," she confessed. We learned that this was their third attempt to get into the museum. "My husband said we can't afford to go to Cairo (although there are four other American cities where the exhibit is yet to go)* so if ever I'm going to see the treasures, it has to be now." Their two children were left snug in their beds with a sitter at home in Indiana. When asked what time they would return, they simply replied: "Later."

As the rain increased, umbrellas popped up and our circle of people draped a plastic sheet over their heads as they sat in a huddle playing cards. Enterprising children walked by, selling donuts and Koolaid while others found their refreshments at a snack stand near the head of the line. At 7:30, in the pouring rain, we finished our coffee, sitting back-to-back with an umbrella over our heads as the water dripped down on our legs. Presently a policeman came along and encouraged people to move closer together to prevent latecomers from crashing the lines. This exercise was repeated regularly, and we seemed to make great strides forward although the width of the line broadened significantly each time.

Florence Johnson is publicity director for Bethel College and Seminary, St. Paul, Minnesota.

*Treasures of Tutankhamun will be on view at the New Orleans Museum of Art September 15 through January 15, 1978, the Los Angeles County Museum of Art February 15 through June 15, the Seattle Art Museum July 15 through November 15, 1978, and the Metropolitan Museum of Art in New York City December 15, 1978, through April 15, 1979.

Good King Tut...

A continual stream of people moved alongside, heading toward the front entrance. Were they just milling about to stretch their legs, going up to get information or food, or barging in ahead of us all? It appeared the latter was happening more often than not and that in the anonymity of the crowd it was difficult to determine who rightfully belonged in line.

The crowd welcomed every bit of information that was passed along. "Did you hear that the museum is losing money on the exhibit?" "How can that be with a million people already getting in?" "But we heard it cost a million just to get the exhibit," another said. People even were eager to receive a gospel tract, thinking it was exhibit information to be read in advance.

By 8:00 it had stopped raining, but the sky was overcast and the air clammy and cool. Most of the crowd now was standing, slowly inching their way up the line. For entertainment we watched an Irish setter bounding through the grass playing fetch with his master and early morning traffic and joggers going back and forth along the Outer Drive — all to the tune of a blaring rock radio station which annoyed everyone around.

Suddenly a burst of enthusiasm rose from the crowd. The museum was opening half an hour ahead of schedule and now the procession began a steady move. As the minutes raced by, progress reports were announced from the door. "There is now a four-hour wait to see the exhibit." Let's see — the museum is open from 9 to 9 so that means eight hours of people can still get in.

Standing was more common than walking now, and doubts kept coming to mind. How many people crashed the line ahead of us? Another announcement. "Six hour waiting time for the Tut exhibit." People now were descending the museum steps, walking briskly with a confident look.

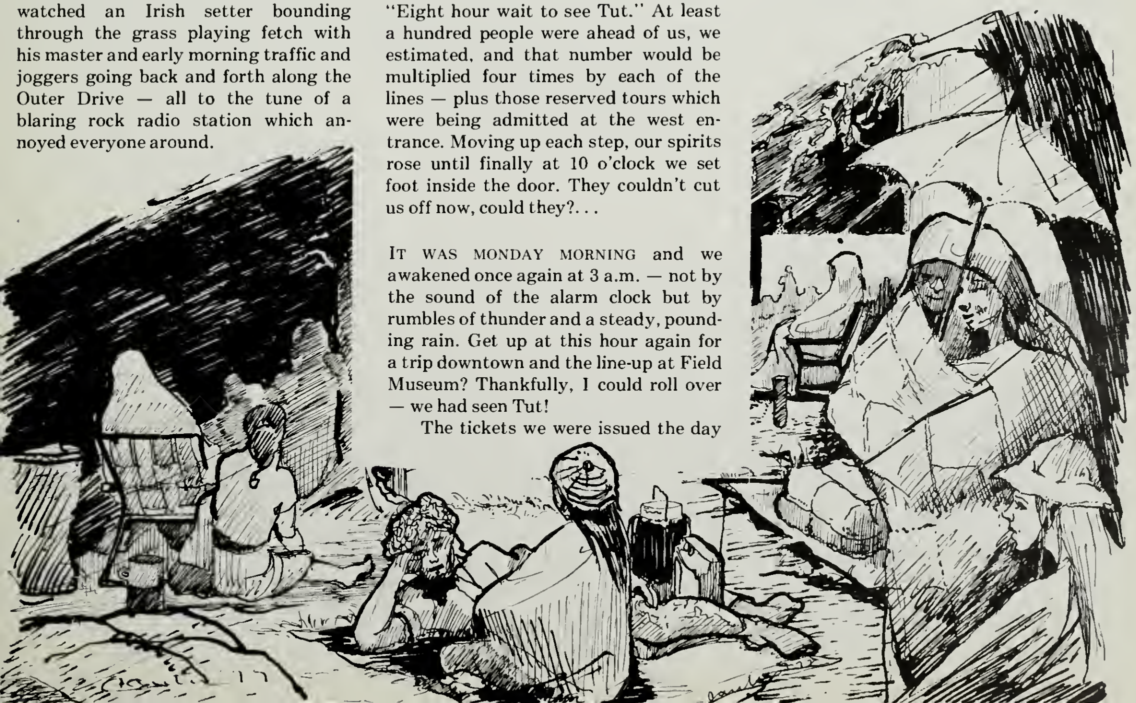
"Did you get tickets?" we asked as they passed by. Nodding yes, we further inquired as to the exact time they got in line.

As we approached the bottom of the steps, another call came forth: "Eight hour wait to see Tut." At least a hundred people were ahead of us, we estimated, and that number would be multiplied four times by each of the lines — plus those reserved tours which were being admitted at the west entrance. Moving up each step, our spirits rose until finally at 10 o'clock we set foot inside the door. They couldn't cut us off now, could they?. . .

IT WAS MONDAY MORNING and we awakened once again at 3 a.m. — not by the sound of the alarm clock but by rumbles of thunder and a steady, pounding rain. Get up at this hour again for a trip downtown and the line-up at Field Museum? Thankfully, I could roll over — we had seen Tut!

The tickets we were issued the day before — 5½ hours after we first got in line — were numbered 5,270 and 5,271, and these we presented seven hours later at the entry to the Tut exhibit and then walked right in. Meanwhile, we left the museum, drove back to Arlington Heights, made a quick change of clothes, sat mesmerized during an hour-long church service, and had a light noontime snack plus a brief afternoon nap before returning to the museum to claim our reward.

"Treasures of Tutankhamun is the most important and beautiful exhibition of ancient Egyptian art ever to come to the United States." So reads the foreword to the souvenir booklet describing this display. How important? How beautiful to the nearly million and a half people who saw it at Chicago's Field Museum? For me, important and beautiful enough to spend weeks of dreaming, hours of waiting, and forever wanting to see it again.



Tut in Retrospect

"Treasures of Tutankhamun" has moved on to the New Orleans Museum of Art, after establishing itself as the most popular temporary cultural exhibit in Chicago's history, drawing more than 1,348,000 viewers. Total Field Museum attendance during the four-month period of the exhibit was 1,742,000. Field Museum's neighboring institutions, the Shedd Aquarium and the Adler Planetarium, experienced attendance increases of 55 to 70 percent during June and July, much of which may be attributed to Tut's presence. The Oriental Institute, which cosponsored the exhibit, also had a great increase in attendance. The Tut gift shop, specializing in Tut-related merchandise, had total sales of $3,364,000.

In response to the exhibit, a great many viewers, members and nonmembers alike, wrote to express their gratitude, excitement, or pleasure. Following are some of their comments:

. . . What can I say to let you know how magnificent an experience this was; may I add my plaudits and thank you; the photographs were outstanding they brought the discovery of the tomb to life, the audio tour was excellent and the actual items from the tomb breathtaking.

The whole presentation of the exhibit was done in a first rate manner, from the design and layout which gave the impression of actually entering the tomb, to the photographs which gave the feeling of sharing the moments of discovery and the excitement of the find and even the way the crowd was handled in entering the Field Museum itself.

What a pleasure it is to find something so rare done on such a plane of excellence.

— *E.S.F.*
Toledo, Ohio

. . . Your maintenance staff is to be commended for doing on outstanding job under unbelievable conditions. I too, am responsible for a public building so I could appreciate what problems the tremendous crowds would cause.

— *G.J.Z.*

. . . Bravos and accolades for your handling of the Treasures of Tutankhamun exhibit . . . This has been handled in the most professional and exemplary manner of anything in my memory. It is a pleasure to be a member. My most hearty congratulations on this most superb offering.

— *B.B.*
Oak Park, Il.

. . . Congratulations on the amazing new 'King Tut' exhibition. It is museology at its most expert peak.

— *E.B.*

. . . Courtesy and unfailing kindness were shown during my visits to see King Tut. Finally made it on the third try!

— *B.M.H.*

. . . Although I waited over five hours to actually see the display, there was none of the anxiety of useless line-waiting so often associated with vastly popular events. Your numbered ticket and TV monitor system was brilliantly logical

— *R.E.*
New York

. . . We were not only thrilled with the King Tut Exhibit but, as always, we came away grateful for the Field Museum.

We were struck by the pleasant attitude and the kindliness of Museum personnel throughout the day. Wherever we strolled there were crowds and a quiet spirit of an enjoyable learning experience. We came away happy to be a small part of it.

— *R.B.H.*
Quincy, Il.

. . . I can't remember another event of this magnitude and importance that has been handled so successfully. All of the effort and hard work has produced a truly outstanding event for which Chicago and its Field Museum can be proud.

— *E.J.F.*
Wilmette, Il.

. . . Please consider this letter as my application to join your wonderful organization. I saw the "King Tut" exhibit . . . and was very much impressed with the wonderful work your organization is doing.

— *D.M.B.*
Chicago

. . . it was superb in its presentation, imaginative and professional, but most of all I would like to commend everyone in the Museum for their courteous and pleasant attitude toward everyone. Thank you. I was truly impressed.

— *P.C.W.*
Houston, Tex.

. . . It was a refreshing and inspiring day in my life. . . .

— *D.L.H.*
Pittsburgh, Pa.

. . . We arrived at the Field the day after King Tut closed, and rather expected a scene of shambles and chaos. Instead, we found a very clean, orderly and calm museum. Even the cafeteria was clean and inviting.

— *D.A.T.*
Arlington, Tex.

Feluccas on the banks of the Nile—photo taken on last year's tour

James Swartchild

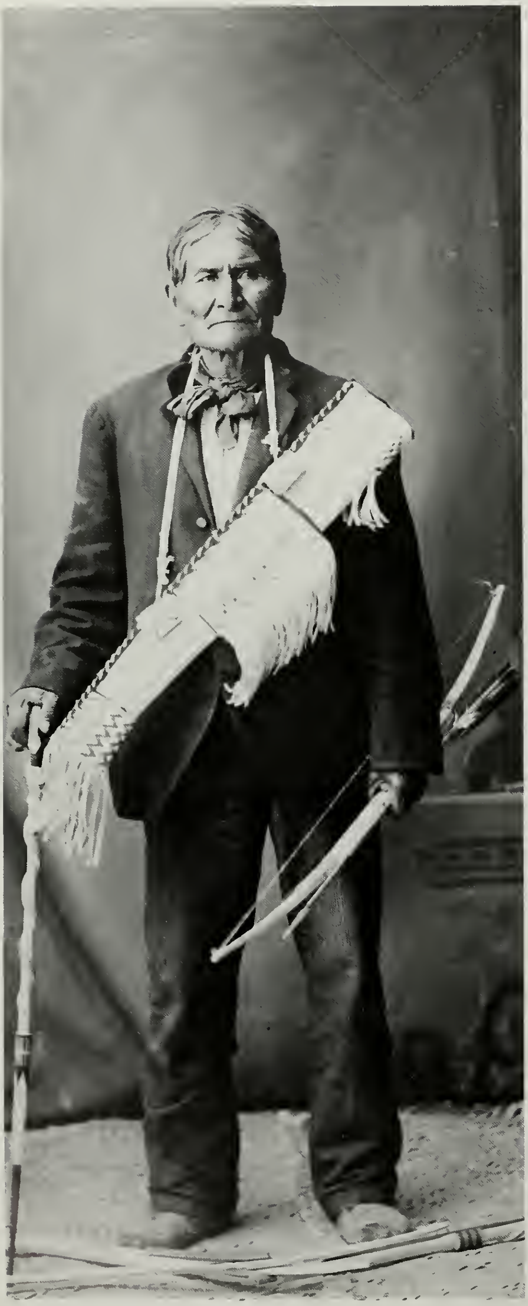
Egypt Tours for Members

Following last year's eminently successful (and fully booked!) tours to Egypt, the Field Museum and the Oriental Institute of Chicago are again sponsoring four tours to Egypt's legendary sites, with Chicago departures January through March. Major sites of the ancient Egyptian kingdoms—including the actual tomb of King Tutankhamun—will be visited.

Each of the 19-day, 18-night tours, limited to 19 persons each (except that departing January 24, which will have 23), will be led by an Oriental Institute Egyptologist, a representative of the sponsoring institutions, and accompanied by a local Egyptian guide and a tour manager.

In addition to the numerous historic sites, superb museum collections in Egypt will be visited, and special arrangements have been made to acquaint members first-hand with the activities of the Epigraphic Survey at Chicago House, Luxor. There will also be a deluxe boat cruise between Aswan and Luxor. Tour dates are: Jan. 5 to 23, Jan. 24 to Feb. 11, Feb. 28 to March 18, March 27 to April 14.

Total cost of each tour, per person, is $2,695.00, which includes a tax-deductible contribution of $500.00 to Field Museum/Oriental Institute. The price also includes air fare and all other transportation and transfers, hotels (double occupancy), and nearly all meals and gratuities. Itineraries, registration forms, and other information may be obtained by writing or calling Dorothy Roder, membership secretary, Field Museum (922-9546).



On Location at the 1904 St. Louis Fair: Charles H. Carpenter, then Field Museum's photographer, records American Indians in their sadness and splendor

By Alan Koss

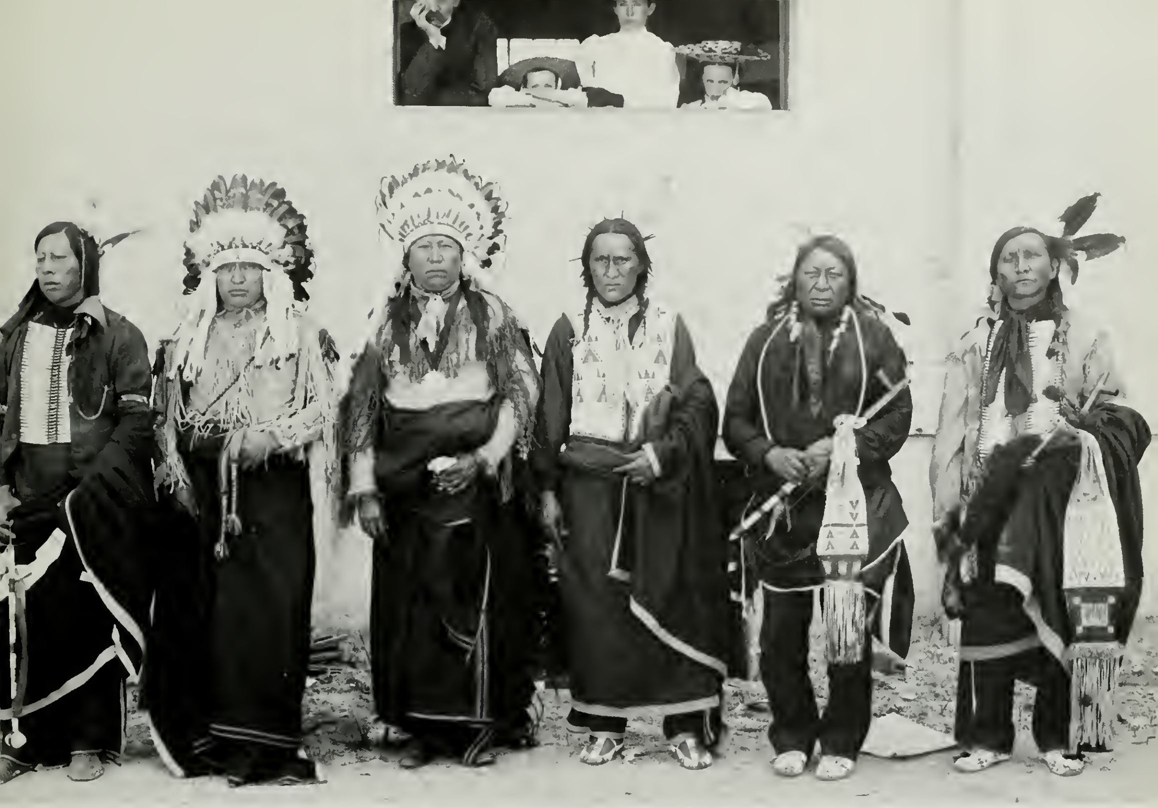
IT'S COMMON KNOWLEDGE that Field Museum was largely an outgrowth of the World's Columbian Exposition of 1893. Less well known is the fact that the Museum, 11 years later, benefitted greatly from the Louisiana Purchase Exposition—the St. Louis Fair of 1904. After that fair's closing, the Museum acquired large collections of natural history specimens that had been exhibited there.

Also acquired were several thousand photos taken at the fair by Charles H. Carpenter, the Museum's photographer from 1899 to 1947. The photos—made with eight-by-ten-inch glass plate negatives—were of people representing racial and ethnic types who were brought to the St. Louis Fair as "living exhibits" from around the world. Most of Carpenter's glass plates are today in the Museum's photograph file, which numbers several hundred thousand negatives. Carpenter's timing was both fortunate and sad, for many of those who posed for him at the fair represented societies that have now vanished and even then were on the verge of extinction.

Of particular interest are Carpenter's photos of Native Americans. It is from this group, including men, women, and children of more than 20 North American tribes, that the photos reproduced here were selected. Even tribal leaders. who had distinguished themselves in warfare against the United States Army posed for Carpenter, among them Geronimo (at left).

The Native American exhibits at the St. Louis Fair included workrooms and booths where artisans, such as the Pomo woman shown opposite, plied their respective crafts. Typical Native American dwellings were constructed on the 1,240-acre fair site and included wigwams, teepees, and even large timber-and-earth structures such as the Pawnee lodge. (The design of the Pawnee earth lodge recently completed in Field Museum's Hall 5 was based in part on Carpenter's photo—reproduced on page 25.)

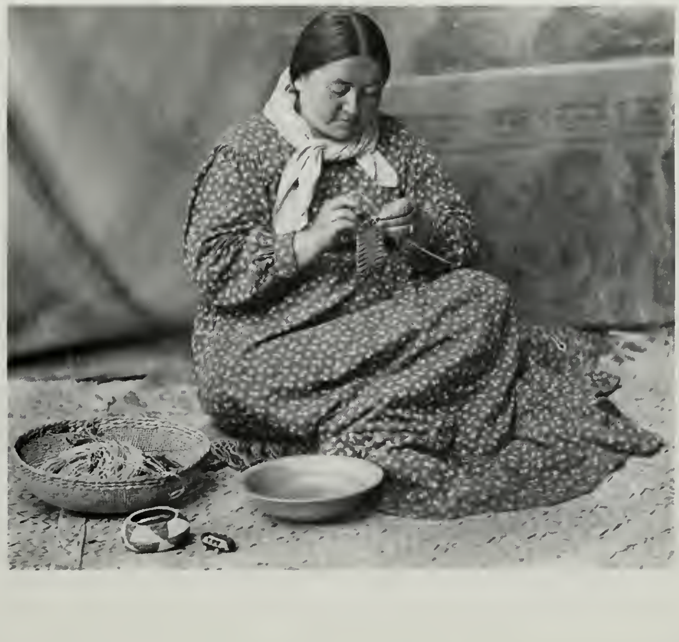
Alan Koss is a Field Museum volunteer.

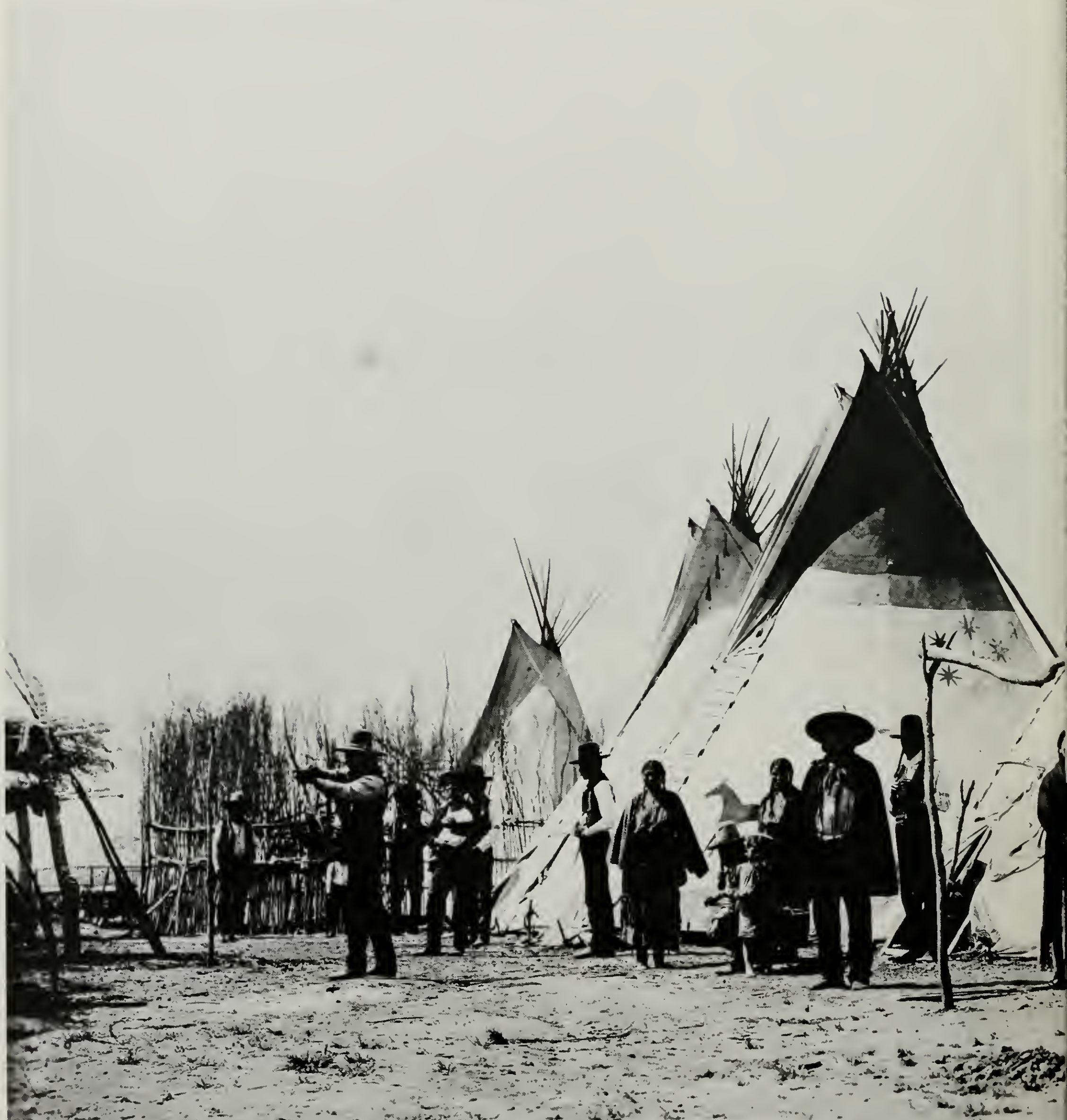


Fair visitors peer through window and unwittingly share Charles Carpenter's camera lens with a group of Cheyenne.

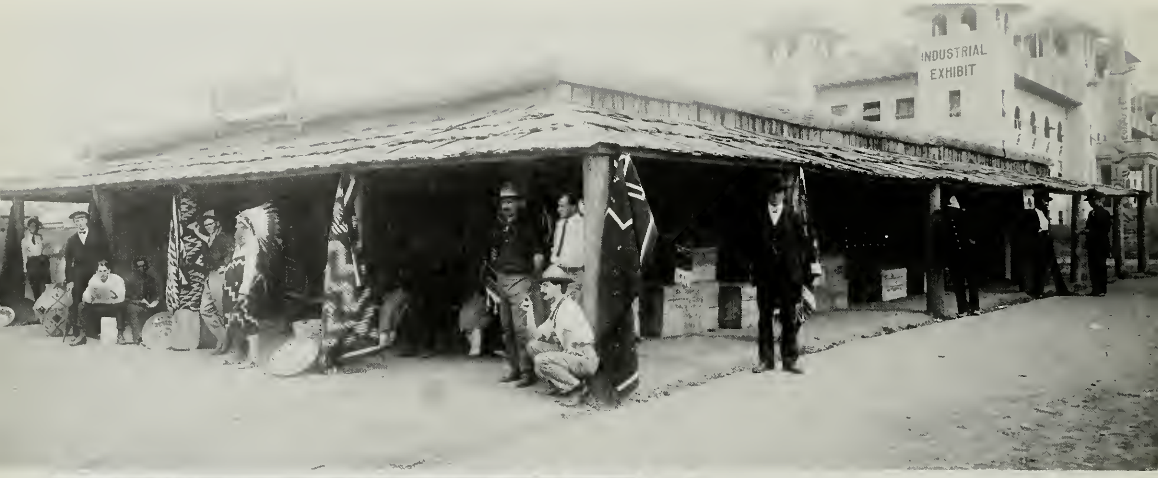
◄ *Geronimo (1834-1909), Chiricahua Apache medicine man and prophet who led his people in uprisings against the U.S. government in the 1880s. A contemporary newspaper account noted that Geronimo "... was accompanied to the exposition by Captain Sayre of the U.S.A., under whose charge the old Indian has been since his stay at Fort Sill. Geronimo spends the day in the Indian building at the World's Fair and as pastime writes his autograph for visitors. He has a special tepee in the Apache village and makes his home with his tribe at night . . . Long years of captivity have broken his spirit but he is still warlike, proud and erect, the true representative of a once powerful race."*

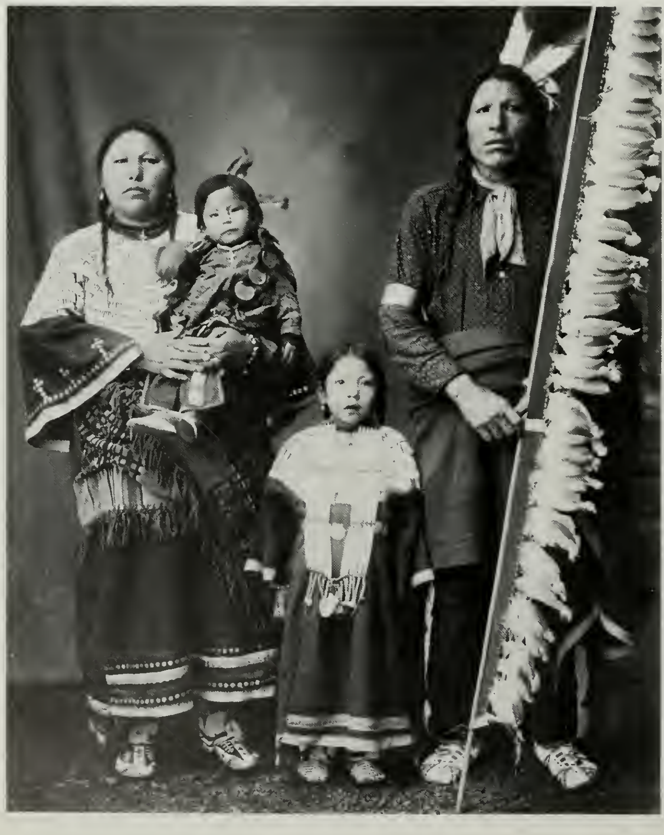
Pomo Indian woman sewing a grass mat ►





Arapahoe Indian teepees set up on the fairgrounds

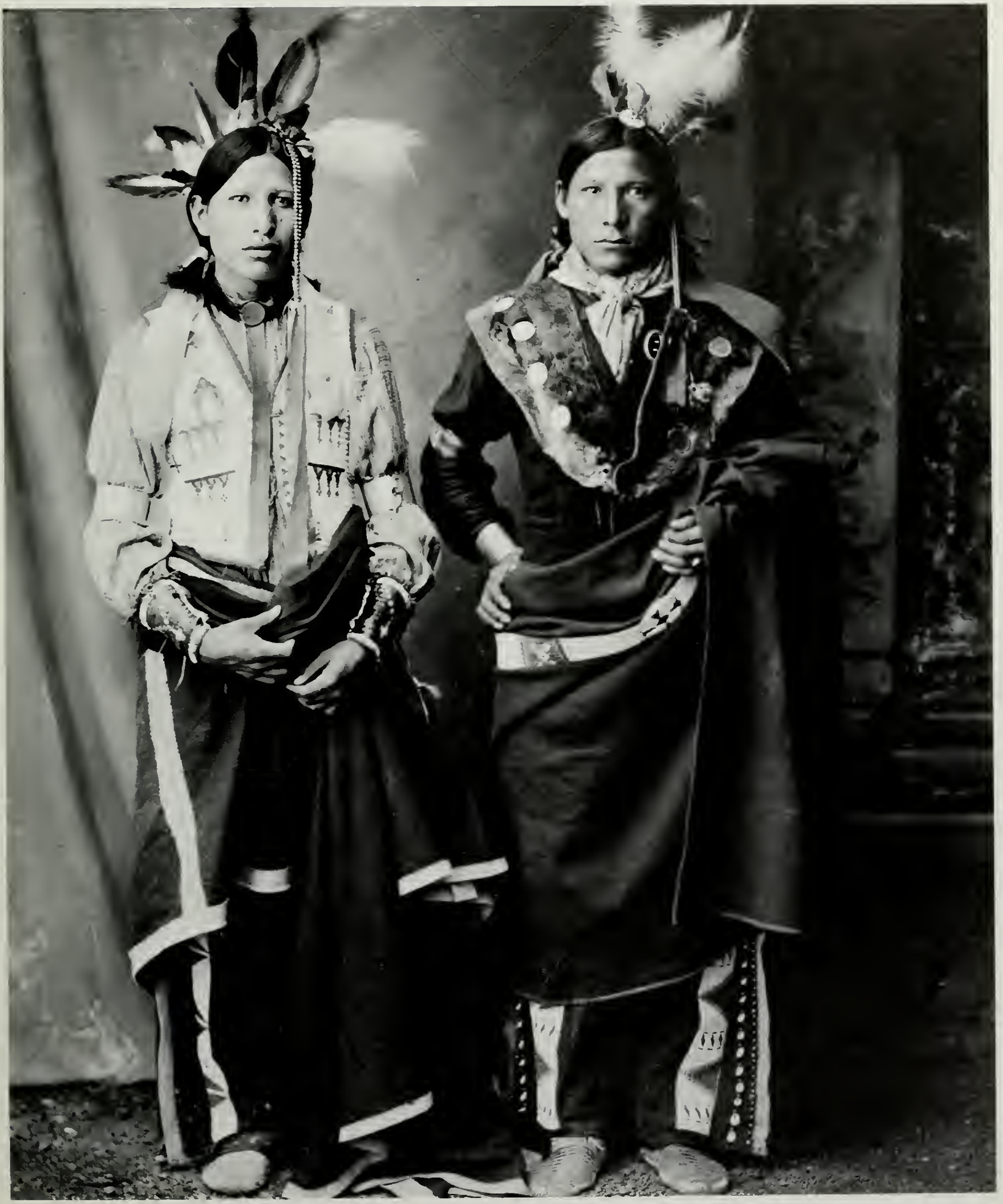




▲ *Indian trading post reconstructed as part of the fair's industrial exhibit.*

Young men of the Oglala Sioux tribe. ►

◄ *A family of Oglala Sioux Indians. Note the combination of European and traditional dress and the Christian crosses worn by the mother and children.*



The Pawnee Earth Lodge

Dave Walsten

Opens October 15

Hall 5 is the site of Field Museum's spectacular new replica of a 19th-century Pawnee earth lodge, open to the public on Saturday, October 15.

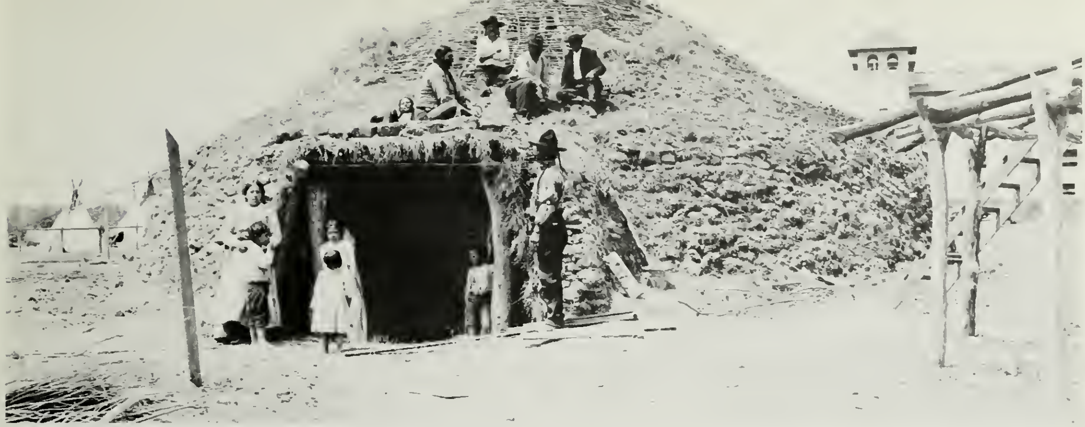
The museum's Pawnee earth lodge is 38 feet in diameter and 18 feet high at the central fire hole. Its traditional east-facing entryway is 16 feet long, 12 feet wide, and eight feet high.

The Pawnee people built their earth lodge frames of cottonwood tree trunks with willow lath. Prairie grass was secured to the willow lath and sod blocks were cut for outer walls. A mudlike mixture was used for the round portion of the roof area. The Field Museum's lodge is also constructed of cottonwood, willow, and prairie grass. Only the sod blocks and roof area are of different material—dyed plaster.

The replica will move visitors back in history to the 1850s when the Pawnee—hunters and farmers—lived in earth lodges along the Loup River in Nebraska. (The Pawnee Indians were forced to move westward from Nebraska to Oklahoma during the 1860s and 1870s. An "agreement" to move was signed by the Pawnee and U.S. government in 1859 as the result of settler expansion into Nebraska.)

The earth lodge interior will be furnished with traditional buffalo robe-covered beds. Pawnee clothing, tools, weapons, and trade store items will be kept, as the Pawnee stored them, under beds, against wall posts, and suspended from the ceiling. Two holes in the center of the lodge recreate the essential fire hole and an underground food storage area.

Original earth lodges, twice the size of the museum's replica, were constructed to shelter extended families of 30 to



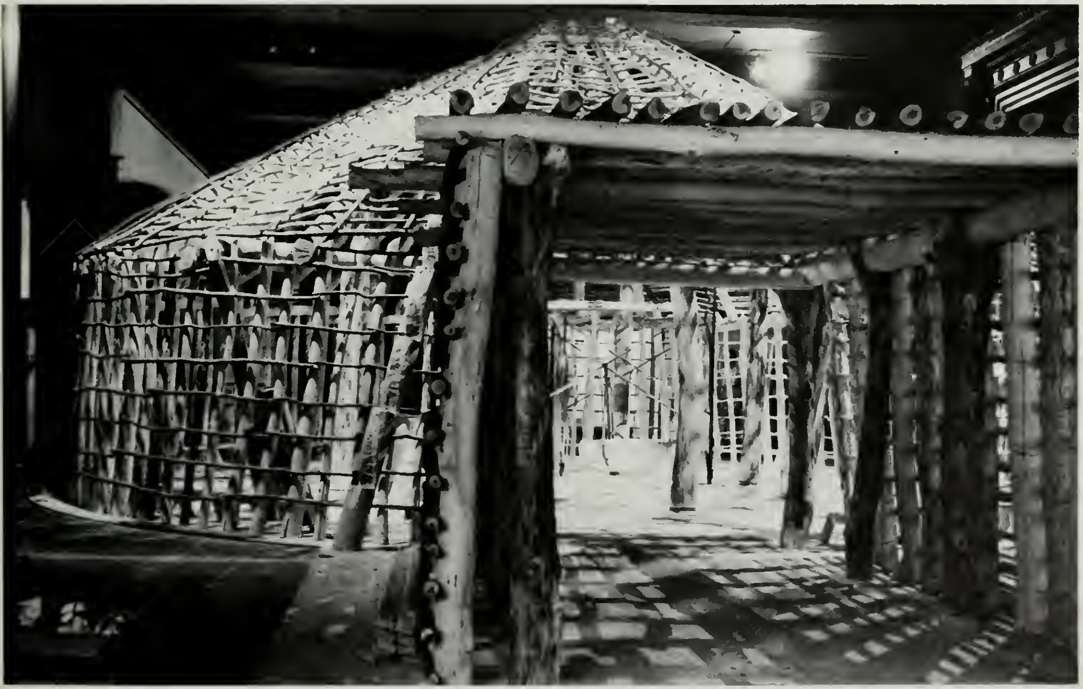
Full size Pawnee earth lodge built at the St. Louis Exposition of 1904. Photo by Field Museum photographer Charles Carpenter.

◂ *Interior of Field Museum's partially completed earth lodge*

50 people. The earth lodge at the Field Museum will seat 45 visitors on its buffalo robe-covered beds and on the floor. It will be the environment for formal programs for museum visitors and preregistered groups of adults and school children.

Members of the Pawnee (Oklahoma) tribe have generously served as consultants to the creation of the earth lodge, have made some of its objects, and have participated in taping four programs of seasonal Pawnee activities and ceremonies of the middle 19th century. Members of the museum's education department and trained volunteers will add continuity to the programs.

Exterior of the partially completed earth lodge at Field Museum.



Dave Walsten

Edward E. Ayer Film Lecture Series

October and November

Saturdays, 2:30 p.m.

This season's film lectures are to be held in James Simpson Theatre, renovated earlier this year. The entrance to the theatre is conveniently located just inside the Museum's west entrance. This is of special interest to the handicapped, for the new west entrance is now at ground level and all steps between curbside and theatre have been eliminated. The west entrance also provides free admission to the theatre. Access to other Museum areas, however, requires the regular admission fee (except on Fridays) or membership identification. Plan to have dinner in the Museum's new dining area before attending the lectures.

The illustrated lectures are approximately 90 minutes long and recommended for adults. Reserved seating is available for members and their families. Doors open at 1:45 p.m.

October 1

SWITZERLAND TODAY *Presented by Willis Butler*

Famous for its spectacular Alpine scenery, this highly industrialized little country still retains its picturesque charm. In his latest film, Butler highlights Switzerland's geography, history, economy, government, and sports.

October 8

COLORADO *Presented by Frank Nichols*

Film highlights of Colorado include Dinosaur National Monument, Mesa Verde, the Royal Gorge, annual festivals and rodeos, and many other fascinating areas and events.

October 15

NORTHWESTERN ADVENTURE: IDAHO, OREGON, WASHINGTON

Presented by Dennis Cooper

Travel the rugged northwest coast through the Olympic rain forests up to the majestic Olympic Mountains—Rainer, Baker, and Hood. Cruise on the incredible Cooper steamboat through Puget Sound and down the Snake River, Idaho. See a wilderness of wild animals, towering mountains, and white water.

October 22

A NEW NORWAY *Presented by John Roberts*

A memorable journey through the land of modern Vikings shows us Norway's people, countryside, and way of life. Visit Stavanger and her industries of the sea; Bergen; Finnmark, home of the Lapps; Oslo the capital and cultural center; Telemark for skiing; and Geiranger one of the most photographed fjords in the world.

October 29

CEYLON—THE MAGIC ISLAND

Presented by Ed Lark

Ceylon is an island of vast differences in geography, weather, people, and plant and animal life. Discover a beautiful country of tropical jungles, impressive mountains, rare gems, monsoons, gigantic reservoirs, and magnificent temples and stone carvings of Buddha as you tour its cities and villages.

November 5

GERMANY

Presented by Dick Reddy

Follow Mark Twain's travels as he rafted the Neckar River, visited Heidelberg Castle, Baden Baden, and other beautiful historic places from Berlin to the castles of King Ludwig II at Linderhof.

November 12

COLOMBIA—FROM THE ANDES TO THE AMAZON

Presented by Ralph Gerstle

From snow-covered peaks to the mighty river, you explore Cartagena, a living museum of the colonial era; La Guajira and San Andres on the Caribbean coast; modern Bogota with its skyscrapers, collections of Precolumbian artifacts and fabulous emeralds; Cali—its orchid farm and sugar cane; and San Agustin, Colombia's most interesting archaeological site.

November 19

THE ALPS TO THE RIVIERA

Presented by William Sylvester

This is the story of people and places in and on both sides of the Alps, quaint villages, age-old traditions in the Alpine heartland, and the enchanting Rivieras along the Mediterranean.

November 26

YOSEMITE AND THE HIGH SIERRA

Presented by Bob Roney

A rich visual documentation of the Sierra Nevada Mountains and of man's way of viewing nature: from exploration to exploitation.

October & November at Field Museum

(OCTOBER 15 THROUGH NOVEMBER 15)

New Exhibits

Pawnee Earth Lodge—opens October 15. Field Museum's newest permanent exhibit is a replica of a traditional Pawnee earth lodge—the home and ceremonial center as it existed in the mid-19th century. The circular lodge, symbolic of the universe, is constructed of cottonwood tree trunks with willow lath, prairie grass, and simulated mud. Participatory formal programs (45 minutes) provide visitors with the opportunity to learn about daily Pawnee life while seated on buffalo robe-covered beds. Check museum electronic monitors for specific times. Hall 5, main floor.

Contemporary Southern Plains Indian Metalwork—opens October 15. An exhibit of contemporary metalwork created by 15 outstanding Native American craftsmen from western Oklahoma. The 110 items comprise the first comprehensive exhibit documenting the historic development of an unusual Native American craft technique, German silver metalwork. Check museum electronic monitors for specific location. Through January 15, 1978.

Iroquois Kitchen. This exhibit shows how traditional Native American ritual is preserved in a modern setting. Hall 5, main floor. Permanent.

Exotic Flyers: Portraits of Neotropical Birds. An exhibit of exquisite bird illustrations appearing in the recently published *Manual of Neotropical Birds* (University of Chicago Press), Vol. 1, by Emmet R. Blake, emeritus curator of birds. Hall K, ground floor. No closing date.

New Programs

Native American Arts and Artists—October 15, 16, 17. Beginning at 9:30 a.m., outstanding craftspeople will demonstrate traditional Indian arts: woodcarving, bonecarving, silverwork, beadwork, and quillwork. A rare opportunity to see artists at work and to ask questions. Check museum electronic monitors for specific times and locations.

"Origins," An Illustrated Lecture—October 28, at 7:30 p.m. Richard E. Leakey, director of the National Museums of Kenya and distinguished anthropologist and paleontologist, will present a lecture, with slides, of his pioneering and exciting study of human evolution. Mr. Leakey, son of Louis and Mary Leakey, will also autograph copies of his new book, *Origins*, following the lecture. Simpson Theater, ground floor west.

Ayer Film/Lecture Series. Each Saturday, at 2:30 p.m., sit back and enjoy a ninety-minute adventure in a remote or familiar area of the world. The films are personally narrated by their film makers. Reserved seating is available for members and their families. Doors open at 1:45 p.m. Simpson Theater, ground floor west.

October 15	*Northwestern Adventure: Idaho, Oregon, Washington* by Dennis Cooper
October 22	*A New Norway* by John Roberts
October 29	*Ceylon: The Magic Island* by Ed Lark
November 5	*Germany* by Dick Reddy
November 12	*Columbia: From the Andes to the Amazon* by Ralph Gerstle

The Place for Wonder. This gallery provides a place to feel, handle, sort, and compare natural history artifacts and specimens. Trained volunteers are on hand to help guide in exploration. Open weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near the new cafeteria. No closing date.

Male and Female: Anthropology Game. The exhibit where visitors become anthropologists. Examine 38 artifacts, decide which were used by men, by women, or by both sexes. Discover that economic and social roles of the sexes are not universally the same. Ground floor, near the elevator. No closing date.

Autumn Journey: Cook's Tour. Self-guided tour leads children through the museum's exhibits of Plains Indians, Woodland Indians, and Indians of California to learn about their food, cooking utensils, recipes, and food preparation. Free *Journey* pamphlets are available at the information booths, main floor. Through November 30.

On Your Own. Adult- and family-oriented self-guided tour booklets are available, for 25 cents, at the entrance to the Museum Shop, main floor north. Adult series: *Animals in Egyptian Mythology*, *The Iroquois: Culture in Transition*, and *China in the Ch'ing Dynasty*. Family Series: *Friend or Foe?*, *The Artist's Zoo*, *Chicago: My Kind of Town*, and *Tibet: Nomads of the Mystic Mountains*.

(Continued on back cover)

October and November at Field Museum

(CALENDAR continued from inside back cover)

Man in His Environment. This exhibit offers a worldwide perspective of environmental problems. It asks you to consider our present realities and future possibilities. Hall 18, main floor. Permanent exhibit.

The Ancient Art of Weaving. Weaving and spinning demonstrations every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

Javanese Music and Dance Performance—November 9, at 8:00 p.m. The Performing Arts Program of the Asia Society will perform *Penca*, a dance from the Art of Self-Defense, and *Topeng Babakan*, a village mask dance with one dancer changing masks and assuming the roles of four or five different characters. Both dances will be accompanied by the museum's newly renovated gamelan—Javanese orchestral ensemble. Simpson Theater, ground floor west. Free tickets are available at west door.

Javanese Dancers Perform November 9

Audio Information System. The museum's newly installed audio system, Uniguide, enables visitors of all ages to visit selected exhibits in any sequence they choose. Complete with background music, sound effects, and factual information supplied by the museum's scientific and education staff, this system provides an entertaining as well as educational experience. Specially designed audio receivers and maps are available for a nominal fee at the entrance to the Museum Shop, main floor north.

Weekend Discovery Programs. Guided tours, demonstrations, and participatory museum-related activities. An educational and entertaining way to spend part of a weekend. Saturdays and Sundays, 10 a.m. to 3 p.m.

Special-Interest Meetings Open to the Public

Oct. 4, 7:30 p.m.	**Kennicott Club**
Oct. 7, 8:00 p.m.	**Chicago Anthropological Society**
Oct. 9, 2:00 p.m.	**Chicago Shell Club**
Oct. 11, 7:30 p.m.	**Nature Camera Club**
Oct. 12, 7:00 p.m.	**Chicago Ornithological Society**
Oct. 12, 7:30 p.m.	**Windy City Grotto**
Oct. 13, 8:00 p.m.	**Chicago Mountaineering Club**
Oct. 18, 7:30 p.m.	**Chicago Audubon Society**
Oct. 30, 2:30 p.m.	**Illinois Audubon Society**

October and November Hours

The Museum Opens daily at 9 a.m. and closes at 5 p.m. During November, the museum closes at 4 p.m. Monday through Thursday; 5 p.m. Saturdays and Sundays. On Fridays, year-round, the museum is open to 9 p.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday. Obtain pass at reception desk, main floor.

Museum telephone: 922-9410.

November
1977

Field Museum of Natural History Bulletin

Field Museum
of Natural History
Bulletin

November 1977
Vol. 48, No. 10

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Staff photographer: **Ron Testa**

Field Museum of Natural History
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President and Director: **E. Leland Webber**

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CONTENTS

3 **Field Briefs**

4 **Monkeys Inside and Out**
Exhibition of drawings and paintings opens November 15 in Hall 9

6 **Mammal-Collecting in the Australian Outback**
by Laurel E. Keller, technical assistant, Division of Mammals

11 **Cloud Forests**
By William Burger, associate curator of botany

18 **Warp of Cedar, Weft of Spruce: Baskets of the Pacific Northwest**
Exhibit of Native American Indian baskets opens December 15
by Helen Chandra, Dept. of Exhibition; Maija Sedzielarz, volunteer; and Ron Weber, Dept. of Anthropology

22 **Rebirth of the Gamelan**
Javanese orchestral ensemble resurrected after 80 years in Museum storage
by Sue Carter-De Vale and Louis Pomerantz

24 **On Your Own at Field Museum**
by Audrey Hiller

27 **A Christmas Afternoon at Field Museum**
Members' Christmas party, Monday, December 19

back cover **November and December at Field Museum**
Calendar of coming events

The editor gratefully acknowledges the editorial assistance of Field Museum volunteers Hermann C. Bowersox and William E. McCarthy in the preparation of this issue.

COVER

Cloud forest and waterfall above the Río Sarapiquí in Costa Rica. Photo by William Burger, associate curator of botany. See "Cloud Forests," p. 11.

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Field Briefs

Curator Terrell Returns from South Pacific

John Terrell, associate curator of Oceanic archaeology and ethnology, has just returned from another trip to the South Pacific. He was away for seven weeks attending an international conference in Sydney, Australia, and doing ethnohistorical research with archival collections in New Zealand and Australia. The conference, on "Exchange Systems in Australia and the Pacific Islands," celebrated the 150th anniversary of the famed Australian Museum.

Terrell's research focused on the Solomon Islanders in the 19th and early 20th centuries and was part of the groundwork he is laying for a new series of expeditions to Bougainville, Choiseul, New Georgia, and the Shortland Islands in the northwest Solomons. His trip was supported by a Fellowship for Museum Professionals awarded him by the National Endowment for the Arts.

NSF Grants

Five separate grants, totalling $175,400, have been awarded by the National Science Foundation to Field Museum for research in five Museum departments.

"Care and Use of the Systematic Collection of Mammals," a project under the direction of Ronald W. Turner, assistant curator and head of the Division of Mammals, has been awarded a grant of $10,600.

"North American Ordovician Receptaculitid Algae," a project under the direction of Matthew Nitecki, curator of fossil invertebrates, has received a grant of $67,100 to support two years' work.

"Floristics of Costa Rica," a project under the direction of William C. Burger, associate curator of botany, has received a grant of $23,100.

"The Care and Use of Systematic Collections of Insects," a project under the direction of Rupert L. Wenzel, chairman of the Department of Zoology, has received a grant of $46,000 for three years' work.

"Systematics and Biogeography of Camaenids," a project under the direction of Alan Solem, curator of invertebrates, has received a grant of $28,600 for continued support.

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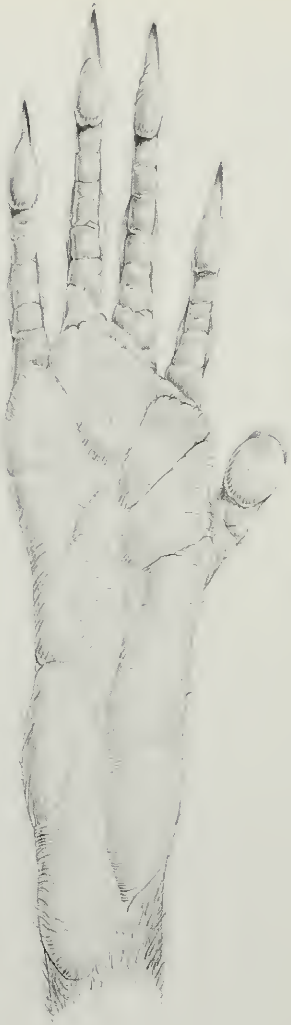
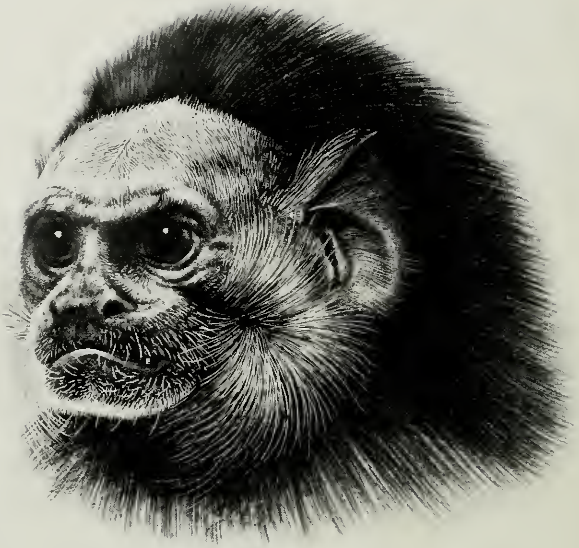
I certify that the statements made by me above are correct and complete —Norman W. Nelson, asst. dir., admin.

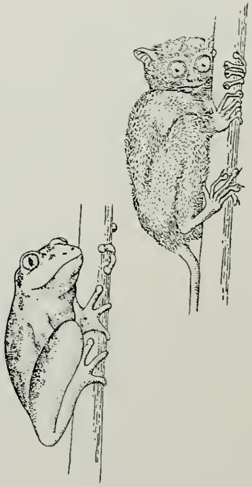
5,000-year-old Sumerian Stag Reunited with Antlers

Holding his remarkable discovery, University of Heidelberg graduate student Michael Müller-Karpe, 22 (below), displays the antlers of a 5,000-year-old Sumerian copper stag which he uncovered in a small box of dried mud in a Field Museum storeroom. Müller-Karpe was examining hundreds of metal vessels from the ancient Near East when he came across the box with its precious contents which "looked like green coral." He had no idea what he'd found until he recalled a world-famous, mainly antlerless stag decorating a rein-holder elsewhere in the museum. His keen mind suddenly identified the "coral" as the corroded antlers of the 7½-inch stag. The stag is a very rare example of decorative Sumerian art created 1,000 years before the art of Egypt's Tutankhamun.

Fleur Hales







Illustrations from Living New World Monkeys (Platyrrhini): *foot of golden tamarin, drawn by Samuel H. Grove; head of silvery-brown tamarin by E. John Pfiffner; and vertical clinging in tarsier and spotted frog, by Marion Pahl. Reproduced courtesy the University of Chicago Press.*

New Exhibit, "Monkeys Inside and Out," Heralds Publication of Monumental Work by Philip Hershkovitz

The world's outstanding authority on the monkeys of tropical America, Philip Hershkovitz, has been on the Field Museum staff since 1947. Now curator emeritus of the Division of Mammals, his main endeavor during the past several years has been the completion of the first volume of a monograph entitled *Living New World Monkeys (Platyrrhini)*, to be published this month by the University of Chicago Press.* An exhibit, "Monkeys Inside and Out," featuring some of the art work in Hershkovitz's book, opens November 15 in Hall. 9.

Hershkovitz's 1,137-page work has been described by Ronald Singer, eminent University of Chicago zoologist, as ". . . monumental, . . . a masterpiece of detailed knowledge and conceptualization. A 'classic,' scholarly enterprise of grand proportions. . . ." It is the most thorough and comprehensive treatment of living New World monkeys ever published.

Hershkovitz states that in writing the work he had two primary objectives: "The first of these was investigation into the origin, evolution, dispersal, and interrelationships of New World monkeys. The second was the definition and treatment of primates as wild animals with no other destiny than living in harmony with nature."

This first volume (of a projected three) is divided into three parts. The first part includes a brief history and the definition, characterization, and comparison of primates as a taxonomic unit. Part two deals with the comparative anatomy and evolution of living New World monkeys. Part three is on the taxonomy and biology of the families Callitrichidae (marmosets and tamarins) and Callimiconidae (callimicos). This is followed by a bibliography of more than 2,500 sources of published information and a gazetteer listing more than 700 collecting and observation localities shown on the distribution maps.

Hershkovitz spent a total of 11 years in the tropics studying monkeys and other mammals in their natural habitat. Most of his expeditions have been of a few years' duration to permit the observation and collection of large numbers of animals with the changing seasons.

Born in Pittsburgh, Hershkovitz matriculated at the University of Pittsburgh and continued his undergraduate and graduate work at the University of Michigan. Working with seemingly endless energy and enthusiasm, he has written more than 200 scientific papers on mammals and a number of book-length monographs in addition to *New World Monkeys.*

The 520 figures and 7 color plates in the new work were produced by several artists. Most were done over a period of years by Samuel H. Grove, Marion Pahl, and E. John Pfiffner. Grove, now director of the Museum of the Southwest, was on the Field Museum staff for 28 years. He was a student at the Art Institute of Chicago and studied biology at Washington University, Miami University, and Northeastern University. His work has been widely exhibited and has appeared in a great number of popular and scientific publications. Marion Pahl, a graduate of the Art Institute of Chicago, joined the Field Museum staff in 1956. Before that she operated an art school and fine arts gallery in Berwyn, a Chicago suburb. Since leaving the Museum in 1969 to do free-lance work, Pahl has continued to do scientific illustrations for the Museum as well as for various publishers of textbooks, encyclopedias, and trade books. Her paintings are in private collections and her botanical drawings are in the collection of the Hunt Botanical Library, Carnegie Institute. E. John Pfiffner studied art at the Chouinard Art Institute, Los Angeles, and served on the Field Museum staff from 1955 to 1963. A free-lance illustrator since 1963, Pfiffner has provided the illustrations for a great variety of books and scientific papers. □

Author Philip Hershkovitz observes artist E. John Pfiffner at work on illustration for Living New World Monkeys.

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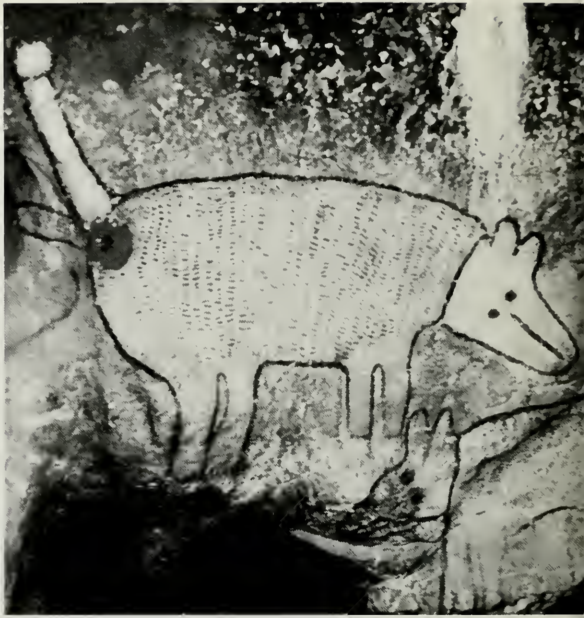
*Living New World Monkeys (Platyrrhini), *Vol. I, © 1977 The University of Chicago Press; 1,137 pp., $75.00 through December, 1977; $80.00 thereafter.*

Mammal-Collecting In The Outback

By Laurel E. Keller

Photos courtesy of the author

This report by mammalogist Laurel Keller is the Bulletin's third on the Western Australian Field Program, which involved Field Museum personnel 1976-77. The two earlier reports, by Alan Solem, curator of invertebrates, appeared in the March and October, 1977, issues of the Bulletin.



Dingos, or Australian wild dogs, drawn centuries ago on a cave wall of the western Kimberley by Aborigines.

We stood dusty, hot, and road-weary outside the Roebuck Hotel in Broome, Western Australia. Our three landrovers had traversed 1,600 miles of flat, isolated Australian interior to reach this jumping-off point to the Kimberly.* Broome is a small fishing and pearling port, inhabited by some 1,500 Polynesians, Japanese, Chinese, Aboriginals, and Caucasians. A year's preparation had preceded this trip, and despite our fatigue, everyone was exhilarated.

Our first field team consisted of William S. and Janice Street, Field Museum field associates from Seattle; Dr. Fritz Lukoschus, ectoparasite specialist from the Catholic University in Nijmegen, Netherlands; Nick Allen, field assistant from the University of Western Australia; myself, and Snow Wallace, cook/camp aide from Shark Bay, Australia. The Streets have led and supported Field Museum expeditions to other far-flung regions, such as Iran, Afghanistan, Nepal, and Peru. They had not only contributed magnanimously to the funding of this trip, but their experience, interest, and hard work made the entire enterprise a more profitable and greater learning experience for us all. [The last prior expedition of the Streets was reported in the October 1976 *Bulletin*, pp. 3-9: "The Field Museum-Street Peruvian Zoological Expedition, 1976," by John J. Pizzimenti—*Ed.*]

Dr. Fritz Lukoschus is a leading world authority on fur and skin mites and spent most of his time at our base camps hunched over microscopes looking for tiny external parasites not visible to the naked eye. Both Nick Allen and I have been affiliated with universities, and relished the opportunity to work in the field on a new fauna and with experienced "field hands." We could always count on Snow Wallace, an Australian "bushman," for first-hand stories of the people and places of the Kimberley, as well as logistical support and tremendous beef stews.

After deciding how to cram tents, food, traps, dissecting equipment, generators, microscopes, sleeping bags, personal clothing, three extra tires, eight five-gallon water containers and six people effectively into three landrovers, we left for a point about 70 miles north of Broome, on the Dampier Peninsula, where we set up our first camp. The inland vegetation here and in much of the southwestern Kimberley locally is called "pindan," or low woodland, with a prominent layer of wattle, or acacia shrubs, over red sandy soils. Perennial tussock grasses and forbs, with an open shrub layer, also acacia, and scattered mixed species of trees, form beach dune communities along the coast.

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*The Kimberley Region is a block of land about the size of Oregon, Washington, Idaho, and Montana combined.

Laurel E. Keller is a technical assistant in the Division of Mammals.

Field objectives, written so easily in research proposals, sometimes were reached only after infinite patience in the field. There we were at our first camp, energetically searching, spotlighting, and checking our traps for four days without finding a single sign of a mammal. Finally, on the fifth morning, I returned to one of our coast sites to find a specimen of that worldwide pest, the common black rat, *Rattus rattus.* I couldn't help grinning as I entered it in the field catalog as our first specimen from northwestern Australia, but we gave it the "full treatment" practiced in all the future processing of collected mammals. Fritz Lukoschus checked it under a dissecting scope, removing the ectoparasites, and then gave it to me. I cataloged it and, when time permitted, removed the stomach for food analysis and internal parasite investigation, and stripped the intestines for additional parasite work. It then passed on to either Nick Allen, who took standard measurements and made study skins, or to the Streets who also took measurements, made blood smears (for blood parasite work), and placed the animals in preservative. From each collecting location, we also gathered plant and soil samples for future species habitat descriptions.

From our first "character building" camp we drove northward into the west Kimberley. This region reminds me of the "Lost Valley." Horizons of open woodland resembling well kept parks of eucalyptus, and various tall grass species spotted with spinifex (*Triodia,* spiky clump grass) were set against ranges of limestone, sandstone, or basalt. It is possible in some areas to identify 15 species of eucalyptus along one mile of road. We worked in the Napier and Leopold ranges, often enjoying the facilities and hospitality of the local station (cattle ranch) personnel. These are vast, self-sufficient operations, consisting on the average of more than a million acres, with 35,000 head of cattle, and generally run by just a handful of dedicated settlers. During the "mustering" season (roundup), Aborigines work with the settlers to round up and sell "bologna bulls"—range bulls sold to canned meat outfits.

We found this area exciting, for the large "roos," or kangaroos, were abundant and it was possible to see five species in an hour of spotlighting. Rock rats, native marsupial cats and mice, echidnas (egg-laying mammals), dingos, and seven species of bats were collected near rocky outcroppings. Fruit bats and tree bats of several species were mist-netted along permanent water pools. On the "dirt tracks" (unpaved roads), cattle, wild donkeys, and emu were constant menaces as they crossed before us unexpectedly.

We chose five sites for intensive faunal sampling and set about to evaluate our techniques. Four types of traps, each specifically effective for collecting certain groups of mammals, were used. In addition to the mouse trap and large rat trap used to collect small mammals such as native mice, rats, and marsupial mice (with pouches similar to kangaroos), we set two different size live traps to capture live specimens of small to medium-size animals such as mice, native cats, and small wallabies. We baited our traps with "universal bait" (peanut butter, sardines, raisins, honey, oatmeal), which amused Snow, who never failed to remark "best fed ants in the Kimberley!" Traps were set systematically. Each trap line was checked every morning and left set for at least four nights. This scheme was used throughout the Kimberley, and enabled us to gather statistical information on the effectiveness of the traps used and to provide estimates of abundance between and among the mammal species collected.

Collecting bats required other techniques. Mist nets (fine mesh nylon nets 7 by 20 feet square) were

Nick Allen, mammals party field assistant, holds black fruit bat, Pteropus alecto. *At dusk, hundreds would fly over our camp to fig tree feeding grounds near Fitzroy Crossing.*

attached to poles and placed over flyways, such as along streams, between trees, or outside caves. Spotlighting, with "head torches," strapped to the head, or powerful 200,000-footcandle spotlights attached to the car battery, was used at night to search for predominantly nocturnal mammals such as bats, marsupial mice, possums, rodents, dingos, and grazing kangaroos.

These techniques enabled us to successfully sample the native mammals of the Kimberley while gathering important information on geographic distribution, habitat preference, and population structure. We also collected external and internal parasites, and data on food habits and reproduction. From this additional data we expect to establish a broader base from which to interpret why a particular species exists and functions in its chosen ecological habitat and niche.

From the Leopold Range, we moved south, working in the Fitzroy Crossing area of beautiful limestone gorges, then headed north to the Admiralty Gulf region. Driving into this country is an awesome experience. The landrover reaches the crest of an outlying hill and in the horizon one surveys hills covered with tall *Livistonia* cabbage palms reaching 40 feet in the air. It is a unique and beautiful region of the Kimberley with laterite, basalt, and sandstone formations carved by rivers falling off to the sea. My reaction was one of disbelief: "Where am I?"

Here we were met by members of Australian agencies representing the Western Australian Museum, National Parks Board, Dept. of Aboriginal Affairs, Dept. of Fisheries and Wildlife, and two television crews. We divided ourselves into international teams to conduct a complete survey of all the fauna of the Mitchell Plateau region. The wildlife was fascinating, particularly the mammals. Blossom bats, three species of marsupial mice, small rock wallabies, bandicoots, and six species of native rodents were collected. In all, 37 species of the approximately 56 species known from the whole Kimberley region were collected in two and a half weeks! However, the weather at times was unbearable. Daily temperatures reached 117°F., with humid showers in late afternoon. Can you imagine a cameraman asking "Would you please do that again?" when they knew that they, too, would have to climb that "bloody hill" again in the heat?

I also will remember the plateau as the farewell site of our first team. Field teams are unusual phenomena. A group of specialists is gathered together from literally different corners of the world at a specific place, for a specific purpose, for a finite period. The past and

Limestone caverns of the southeast Kimberley are ideal bat habitats. Specimens were shot down with .22 calibre revolvers loaded with dust shot, disabling but not killing the animals. Field assistant Keith Morris, with revolver, is aided by local helper Roy Munster, holding flashlight.

Late morning and most of the afternoon were spent in camp processing specimens. Fritz Lukoschus uses dissecting microscope to locate external parasites while Nick Allen and I prepare kangaroo and wallaby for study.

future are irrevelant, the team interacts intensively in the "present" on a 24-hour basis, then disbands to return to their respective personal lives. Fritz Lukoschus flew back to the Netherlands to resume his teaching commitments, the Streets returned to Perth, thence to explore more of the "down under" beauty, and Nick Allen returned to his doctoral work at the University. I found it difficult to say goodbye.

At the Plateau, I was met by Keith Morris, another University of Western Australia graduate student, and later by Roy Munster, a local Australian interested in bats. We finished the dry season work in the arid southeast corner of the Kimberley. Passing through the old historic cattle and goldrush areas of the Ord River basin, we worked in the Durrack and Lawford ranges, where the land is characterized by gently sloping deep sandy soils with spinifex understories and sparse low woodlands. The mammals we captured reflected this southern, desert element in our study areas. The bats particularly were abundant. The end of the dry season is a stressful period for much of the wildlife of the Kimberley. Many of the frequented watering sites dry up and daily highs may exceed 115°F. Bats, as other wildlife, concentrate around the remaining water supplies (permanent pools in the river beds, fresh water springs, and cattle tanks) and it was possible to observe 40 to 50 bats, and mist-net six species in one hour.

With the first thunderstorms foretelling the coming of the wet season, I left the Kimberley after nearly five months in the field, driving to Perth for the Christmas holidays. Two and a half weeks later I returned north, to be astounded by the transformation of the countryside. I had left a dry, burnt land with few permanent water pools, and returned to green horizons of lush regrowth and running rivers. The resilience of the natural environment was incredible, comparable to the transformation from snowy winter to budding spring.

Roger Buick, a graduate of the University of Western Australia, myself, and two "snail people" (Carl

Loading the landrover was a hot, grimy business, happily completed here by Janice and William Street, myself, and Fritz Lukoschus.

Christiansen and Laurie Price) under the direction of Field Museum's Alan Solem, comprised the wet-season team. The snail people and the mammal faction cooperated enthusiastically, with occasional lively dissent about the merits of snail studies versus mammal studies, and such matters as which day of the week it was, when to drive 100 kms to the nearest air-conditioned pub, and when we would get the next letter from the outside world. We resampled the Napier, Leopold, and Fitzroy areas to gather comparable biological information during this season. Particularly, we were interested in determining what changes might occur in the distributions, habitat preferences, reproductive cycles, and feeding habits of the mammals collected as they responded to the alteration in their micro-environment through this second season of the year, the "wet." In other words, we stayed through the wet season to get the complete picture of the annual lifecycle of the animals we studied. However, the proposal was again far simpler than the accomplishment January, the first full month of the wet, was almost completely rain-free, and in February when the station managers generally expected quite a bit of rain, we received much less. The accessibility of the various study areas during this atypical weather deceived us. We ventured forth in our trusty landrover after a one-inch rainfall only to sink over our hubcaps into a black mudhole. For three days, from sunrise to sunset, we lay on our stomachs and dug with shovels and hands to free the vehicle from the ooze. We succeeded only by bailing out the entire pond by bucket.

Wet season work climaxed with a trip north to resample the Mitchell Plateau region, where we were joined by two mammalogists from the Western Australian Museum, and again combined snail and mammal collecting to the benefit of all. The Amax Corporation provided us with the luxuries that one dreams of in the field: air-conditioned living quarters, sheets and pillowcases, cold drinks over ice, and the warm hospitality of gracious hosts! Only the weather didn't cooperate, for we flew into the aftermath of a tropical cyclone (hurricane), waded for two weeks, and left upon the threat of another cyclone. As in our previous visit, however, the mammals were unique.

Returning to Perth, the largest city in Western Australia (100,000), after such an isolated experience in the field was pretty incredible. In addition to the necessary reorganization of specimens for shipment, identification, listing, and donation of specimens to the Western Australian Museum, and paperwork involved in the processing and exportation of nearly 1,250 mammal specimens, I did a great deal of people-watching. The number of new faces, paved streets, and automobile commotion took some reorientation on my part! Finally, goodbyes were said to the many persons we had known at the Western Australian Museum, various private and government agencies, and my field assistants, all of whom provided enthusiastic support for the successful completion of our Australian Field Program.

William Street, a sponsor of the mammal party, examines a newborn marsupial mouse under a dissecting scope at camp in the western Kimberley. Several months earlier, he and Mrs. Street had done similar work in the Peruvian Andes.

The second phase of the Australian project, the cataloging and laboratory analysis, has now begun. This will provide raw material for: 1) a preliminary faunal survey (including systematics, geographic and habitat descriptions, and information on population structure, based on comparative trapping techniques); 2) a food habits study (with Dr. John O. Whitaker, Indiana State University), based on stomach contents; 3) an analysis of intestinal endoparasites (with P. Thomas, University of Adelaide, Australia); and 4) a comprehensive study of the reproductive cycles of the species examined. The potential of this easily accessible Australian collection for future research here at the Field Museum and other American and European institutions, and in applications to the research and conservation work of our Australian counterparts is enormous!

As I sit in the laboratory here at the Field Museum, August 1976 and our arrival in Broome, northwestern Australia, seems like an event both of last week and of years ago. I remember the local Aussies of the bush referring to this phenomenon as "Kimberley time," where the eight-hour work day, the seven-day week, and the progression of months forming defined seasons are all unfamiliar terms. Here in Chicago, we just say "Time sure flies!" ☐

Cloud Forests

By William Burger

Photos by the author

Of tropical plant communities, among the most interesting to the botanist are cloud forests. These usually occur on steep tropical slopes at higher elevations or on small mountains that abruptly rise above the surrounding land.

Here the prevailing winds are forced upward, become cooler, and produce clouds and mist or rain. (The rising air expands because of lower pressure at higher elevations and the expansion causes what is called adiabatic cooling. Refrigerators work on the same principle, first compressing gas and then allowing it to expand and produce the cooling effect.)

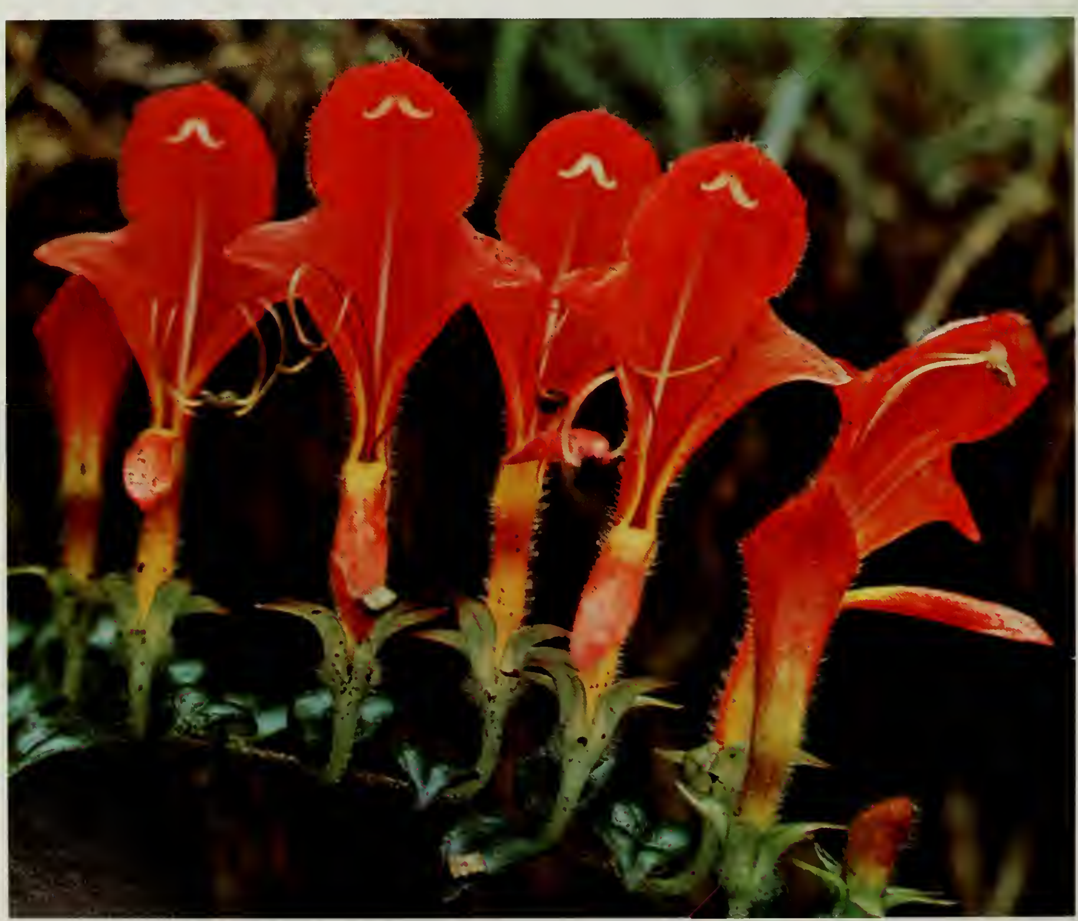
Cloudiness and rain or drizzle have a secondary effect: they screen out the sun and tend to moderate the daily temperature cycle. If the slopes are at elevations of 5,000 to 10,000 feet, the combination of cloudiness, wind, and altitude can make it quite chilly even in midday. The combination of cool, moist weather with frequent cloudiness means that water stress—the threat of drying out—is much less severe in a cloud forest than in most other plant formations. While a lowland rain forest may receive as much precipitation as a cloud forest, the longer clear periods of hot sunshine in the rain forest create very different growing conditions there. ➤

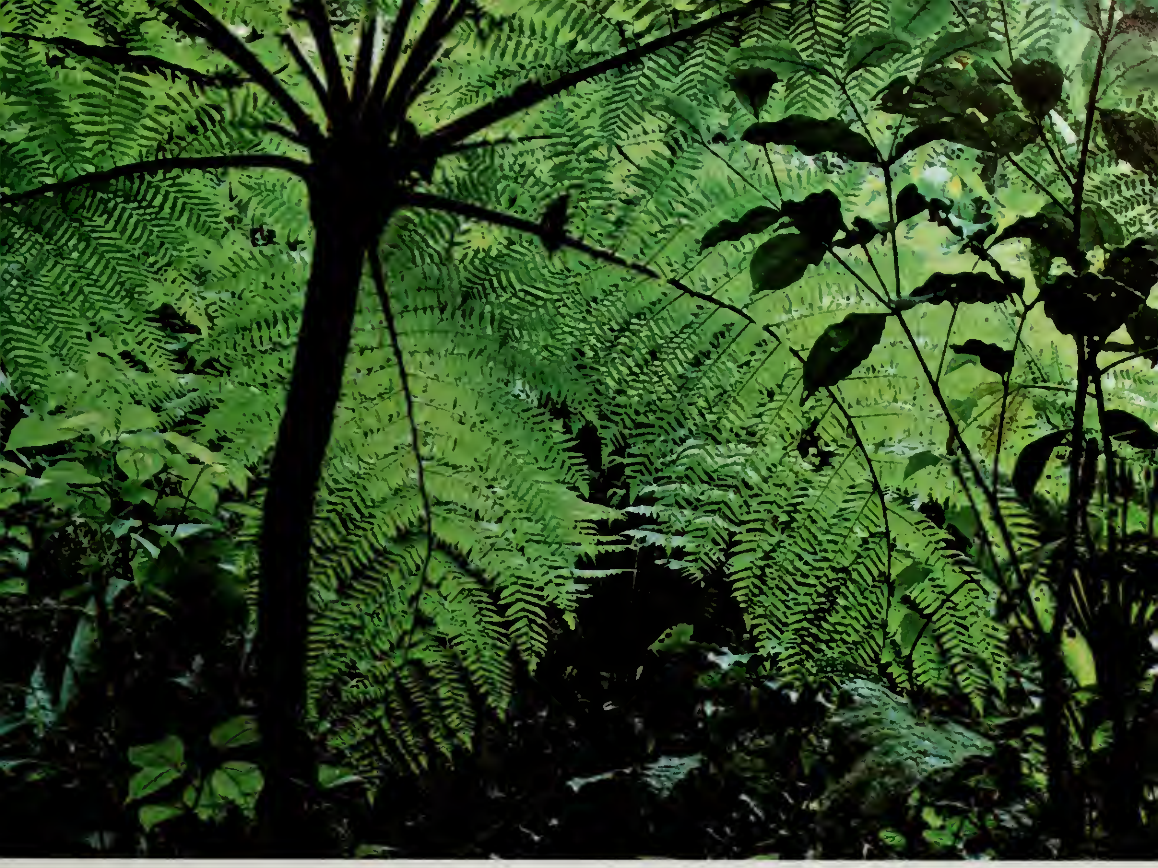
William Burger is associate curator of botany.

The unusual weather conditions of the cloud forest create an appearance that is quite unlike that of forests in the wet lowlands and very different from that of seasonally very dry forests, but it is impossible to define the cloud forest precisely; and attempts to show where one begins or ends, even on a single mountain slope, are quite arbitrary.

Cloud forest trees average between 30 and 80 feet in height, while trees in a lowland rain forest are generally twice as tall. The crowns of typical trees in the two communities also differ considerably. The broad, spreading crowns of the tall rain forest "emergents" that stand above the forest canopy are not to be found in a cloud forest. Instead, crowns tend to be compact or very irregular—conditions often due to breakage by high winds. In

Flowers of Columnea gloriosa, *an epiphytic member of the Gesneriad, or African violet, family.*

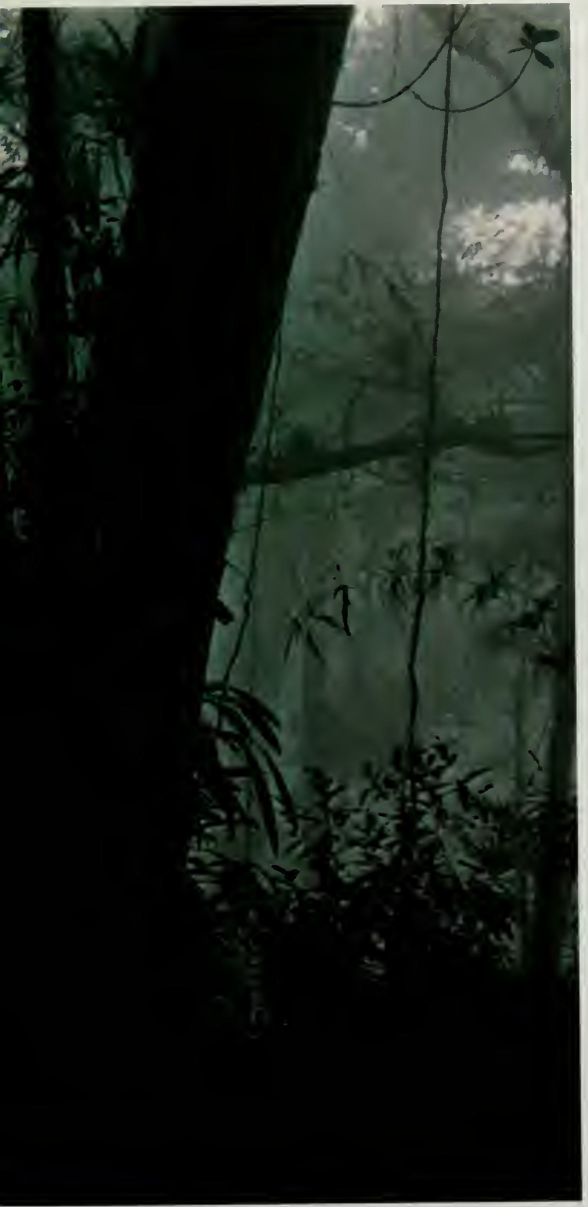




Tree fern in Costa Rica's Monteverde Cloud Forest preserve.

the cloud forest, branches tend to be denser and more numerous, and bear smaller, stiffer leaves. Both conditions are probably in response to frequent winds.

The understory of the rain forest is also distinctly different from that of the cloud forest. While the rain forest usually has a very dark interior, with few small trees and shrubs, the cloud forest understory is usually better illuminated and has a great variety and profusion of plants—especially on very steep slopes and where high winds cause frequent branch falls. The more open nature of the cloud forest favors the abundant growth of small trees, shrubs, and epiphytes—which spend their lives perched on other plants. Epiphytes are not to be confused with parasites—such as mistletoe—which get their water and nutriment directly from the supporting plant, or host. Epiphytes may get nourishment from debris caught in the bark of the supporting branch, but their roots do not invade the host's tissues. Because of frequent rain and misting, cloud forests usually support more epiphytes than any other kind of vegetation and it is here that the epiphytic orchids, bromeliads, gesneriads, ferns, and other "perching" plants are most diverse. ➤



Winds may be especially strong for part of the year on mountain tops and in saddles between ridges. These windy sites often support so-called mossy forests, or elfin forests, which consist of densely crowded, crooked, and stunted trees only 10 to 30 feet tall. Their tops are generally rather flat and uniform in height—the result of strong, persistent winds. Usually, there are few shrubs but a great many mosses on trunks and branches as well as on the ground.

Where slopes are gentler and winds more moderate, the cloud forest gives way to the montane forest, which tends to be taller, and has a darker understory with fewer shrubs and epiphytes. Like the cloud forest, the montane forest is also cool—because of the higher elevation—and most of the trees retain their leaves throughout the year.

The cooler conditions that characterize cloud forests also make them ideal for human habitation and exploitation. Thus, cloud forests are often replaced by coffee or tea plantations, potato or barley fields, dairy pastures, and the like. While cloud forests do not directly produce food for large-scale human consumption, there are sound utilitarian reasons for protecting them, the most important being water conservation. Along ridges and steep slopes these forests intercept the clouds, capture their moisture, and pass it on to feed small brooks and streams. These, in turn, maintain water tables and river flow in the lowlands.

Because cloud forests are often on steep slopes, their destruction can result in severe soil erosion. In their absence, torrential downpours may result in flooding during the rainy season and during the dry season streams that once carried water year-round may cease to flow altogether. Watershed management, especially where reservoirs for household water supply or hydroelectric power are involved, is one of the important ways to ensure the preservation of tropical cloud forests. ➤

Moisture-laden winds from the Caribbean obscure the top of Cerro Zurqui in Costa Rica's central highlands.

Concern over the destruction of cloud forests has yet another, but less utilitarian dimension. Cloud forests can be regarded as cool or moist islands standing above a sea of hotter and drier lowland vegetation. And like islands in the sea, they are often the homes of plants and animals that can survive nowhere else. The more isolated the cloud forest—that is, the more distant from other cool montane forests—the greater the percentage of plants and animals that are apt to be unique. Thus, the destruction of a cloud forest may well result in the extinction of species that are found nowhere else.

The destruction of large portions of our planet's natural diversity is, apparently, ongoing and irreversible. Land that once supported montane tropical forests and cloud forests now produces milk, coffee, tea, grains, and a host of other useful products, including strawberries shipped by air to help us maintain our escalating standard of living. But let us hope, while sipping our coffee and savoring our strawberries, that a few of these unusual forests can be saved and their unique biota preserved. ☐

For Christmas, "Give Field Museum"

Whether you are trying to decide on a Christmas gift for the small child or for "the man who has everything," a gift of membership in Field Museum is always appropriate. And for the budget-minded shopper it's one of those unusual finds — a gift that costs no more than it did a few years ago!

For the adult, a membership provides a wealth of opportunities to further explore the realm of natural history; for the child it can open the doors to a lifetime of scientific interest or professional endeavor. Infinitely more than a storehouse of fascinating specimens and exhibits, Field Museum offers to its members at every age level a varied selection of exciting learning experiences via the classroom, workshop, film, or field trip.

Perhaps equally important: with a Field Museum membership you are giving a shared relationship, for Field Museum is indeed its members.

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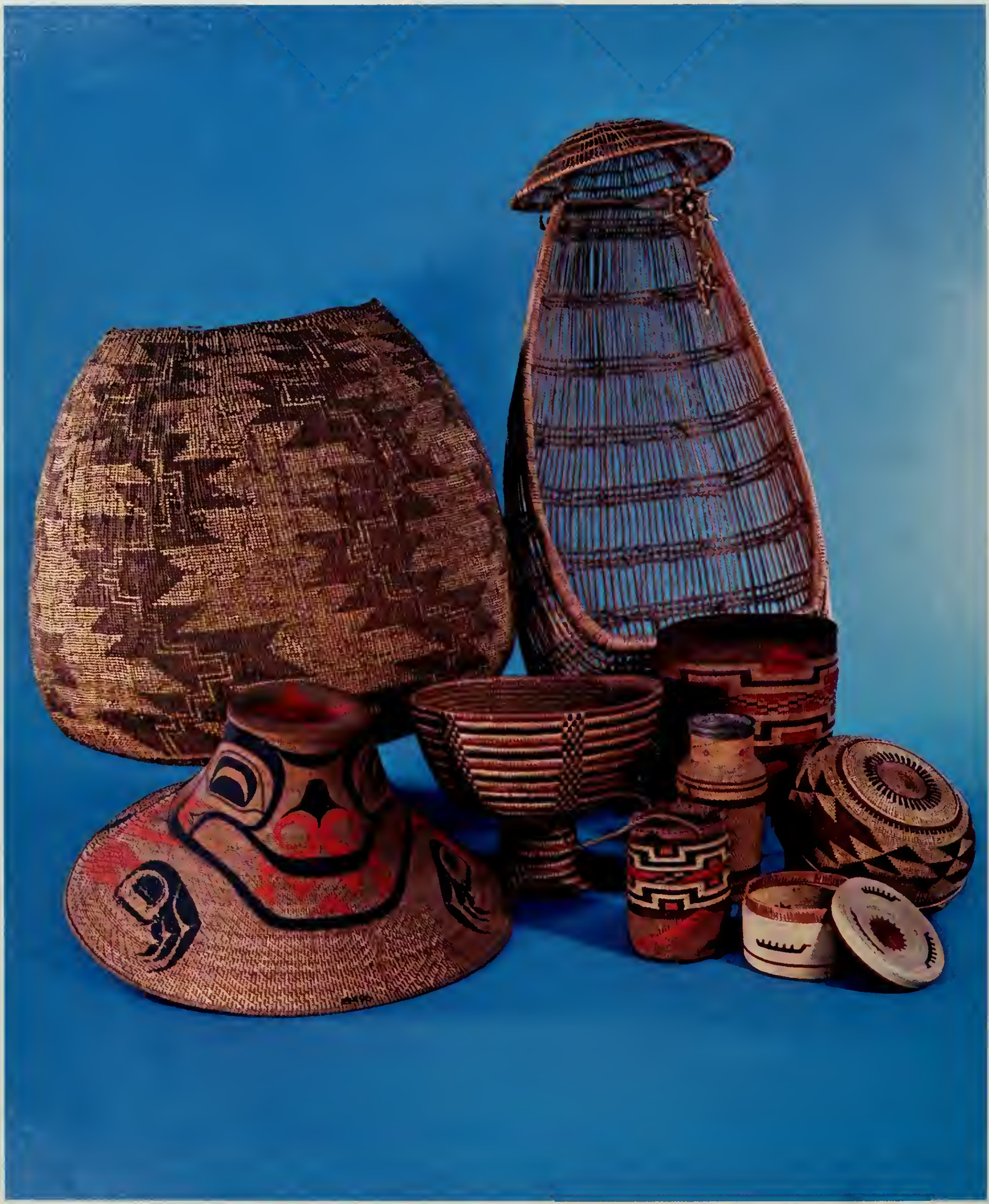


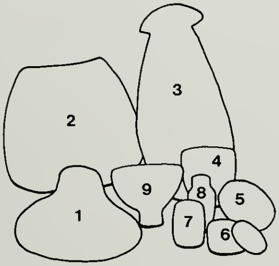
Warp of Cedar, Weft of Spruce: Baskets of the Pacific Northwest

Exhibit of native American Indian baskets opens December 15

By Helen Chandra, Maija Sedzielarz, and Ron Weber

Photos by Ron Testa

The Indians of the Pacific Northwest have long been noted for their skill in woodworking. The complex carved figures, boxes, and masks are full of dramatic power. Among the northernmost groups, the soaring totem poles once stood in front of their villages as magnificent testimony to the artist's use of his native forest resources. But there is another Northwest Coast art that also utilized the products of the forest, a simpler, quieter art: the women's art of basketry.



◄Baskets made by Northwest Coast Indians show an astonishing variety of forms, functions, and techniques. Clockwise from lower left: (1) Haida ceremonial hat in twined spruce root with totemic painted design, Cat. #79498; (2) Hupa acorn storage basket in twined weave with overlay, #86230; (3) Hupa boy's cradle with attached sunshade and toys in twined openwork, #60121; (4) Tlingit berry basket in twined spruce root with false embroidery, #84122; (5) Hupa woman's hat in twined weave with overlay, #258599; (6) Nootka trinket basket with lid, in wrapped twined weave, #82732; (7) Tlingit drinking cup in twined weave with false embroidery, #78993; (8) Nootka bottle covered with wrapped twined weave, for tourist trade, from the collection of M. E. Rada; (9) Salish basket with pedestal base, coiled with imbrication, #85564.

Most of the baskets on exhibit were collected at the turn of the century. Although some women continue to make baskets, for their personal use and for sale to tourists, many traditional forms and techniques have already disappeared from the area.

From Yakutat Bay, Alaska, to Cape Mendocino, California, Indian women have woven and sewn baskets that, in the richness of their designs, the variety of their uses, and the diversity of their techniques, are not surpassed anywhere in the world. Forms and functions range from huge storage containers large enough to hold several bushels of acorns to small, lidded, trinket baskets; from open fishing traps to watertight drinking cups; from babies' cradles to chiefs' hats painted with representations of the clan's totemic animal. The brocadelike patterns of a Tlingit berry basket, in designs with such intriguing names as "the track of the snail," contrast vividly with the bold jagged lines that decorate a Salish storage trunk. All three of the basic basketry techniques known—plaiting, twining, and coiling—were employed by one or more groups of the Northwest Coast. In some instances, fundamentally different techniques were used for similar purposes by neighboring groups. In other instances, traditions intermingled to the point that variations of one or more techniques are found on a single basket.

Environment

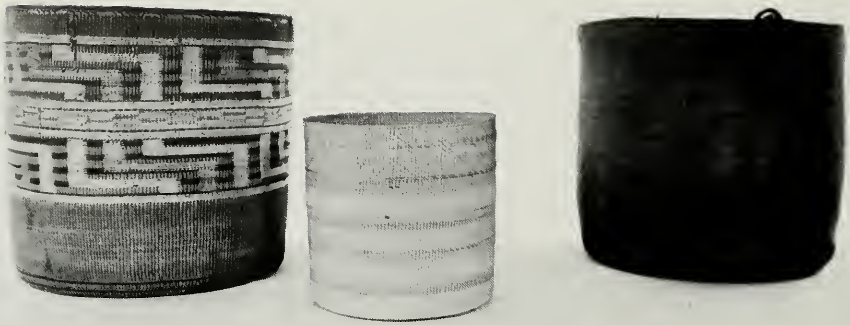
Along much of the coast the Japan Current warms and moistens the air as it blows across the Pacific. The air rises up the flanks of the coastal mountains, is cooled, and releases its moisture in the form of abundant rains on the westward facing slopes. This warmth and moisture produces a lush growth of coniferous forest. The red cedar, which furnished most of the wood for the large plank houses and the canoes as well as for the men's art of carving, also provided bark, which was one of the most important raw materials for basketry. Also utilized, for construction and for decoration, were the roots of the Sitka spruce, various ferns and woodland grasses, and roots and branches of some deciduous trees.

The collection and preparation of basketry materials and their coloring with vegetable and mineral dyes were skills passed from mother to daughter. It was said that the difference between a really fine basket made by a superior craftsman and more inferior work began with the careful selection of the roots deep in the forest.

Techniques

Plaiting is the simplest of the three basic techniques and

The temporary exhibit was organized by Helen Chandra, writer/coordinator, Department of Exhibition; Maija Sedzielarz, volunteer, Department of Anthropology; and Ron Weber, research assistant for the Northwest Coast, Department of Anthropology; under the general direction of James W. VanStone, curator of North American archaeology and ethnology. The exhibit was designed by Rick Shannon.

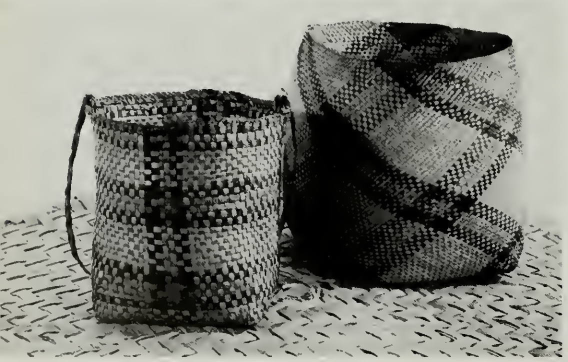


A. The Chilkat subgroup of the Tlingit, other Tlingit, and the Haida, made three characteristic variants of the same twined spruce root basket. The Tlingit basket (left) was decorated with bands of dyed weft and false embroidery, Cat. #84011; the Haida (center), with bands of dyed weft and skip-stitch designs on the rim, #84153; and the plain Chilkat basket (rt.) with skip-stitch design on the rim, #84085.

the one most widely diffused through the area. In plaited baskets, the weft is woven over and under perpendicular strands of warp (*see fig. B*). Both warp and weft are often of the same material. Variations in the pattern are made by varying the weaving sequence, orienting the weaving diagonally, and by employing different colors. Plaited baskets, mats, or portions of baskets finished in a combination of techniques were most frequently made by the Tsimshian, Kwakiutl, Bella Coola, and Nootka, but the Haida, southern Tlingit, and Salish also occasionally used this method.

Although twined baskets were found almost everywhere on the Northwest Coast, the baskets of the various groups show enormous variety and diversity. Materials, basic shapes, decorative additions, and details of manufacture vary from region to region. Basic twining is done with two wefts (horizontal elements) which twist around each other and a warp (vertical element). In the northern regions, the Tlingit and Haida women made the majority of their baskets of spruce root, using basic twining. Ornamentation was added by inserting dyed grasses or spruce root, or by varying the number or spacing of the basic twining elements. Although the Tlingit and Haida baskets are of nearly identical form, their decoration distinguishes them. The Chilkat tribe of the Tlingit made finely woven baskets with decoration produced solely by regularly varying the weave to form relief designs of diagonals, diamonds, and triangles. The Haida and most other Tlingit used this design technique also, but they included decoration made by the insertion of dyed weft to form solid colored bands running horizontally around the baskets. Most Tlingit groups added a type of decoration known as false embroidery to the horizontal bands of color to produce bands of complex design (*see fig. A*).

B. Plaiting was used by most groups for both baskets and mats. Tlingit berry baskets, red cedar, #84152 (left) and #78848; Salish mat in twilled weave, #19626.



A variation called wrapped twining is characteristic of baskets made in the central portions of the Northwest Coast. This included British Columbia, Vancouver Island, and the Puget Sound areas. Here, Kwakiutl, Nootka, and Salish women used a flexible weft of cedar bark or spruce root to wrap around two perpendicular rigid elements, and produced both openwork and tightly woven containers, the form depending on their destined use (*see fig. C*).

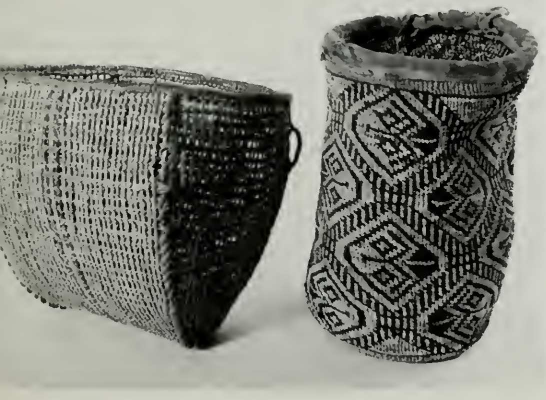
By using rushes, grasses, and other soft materials, Salish women of Washington employed basic and wrapped twining to produce soft and flexible baskets and bags, often decorated with animal or geometric shapes. These designs were made by overlaying the wefts with dyed grasses. A related variety of wrapped twined basket with soft warp was produced by the Chinook of the Columbia River valley. Historically, the wrapped twined baskets of the Nootka may have been related to these Salish and Chinook twined baskets.

Rounded, rigid twined baskets were made by the women of northwest California—the Yurok, Karok, and Hupa—as well as some of the groups living along the Oregon coast (*see plate, p. 18*). The materials most frequently used were hazel and willow shoots and also spruce roots. These twined containers are consequently quite different in appearance from those found in any other area. The baskets are decorated with bands of geometric overlay design. Overlay designs can be distinguished from false embroidery by the slope of the stitches forming the design. Overlay elements always are parallel to the weft elements, while false embroidery elements are perpendicular to the weft.

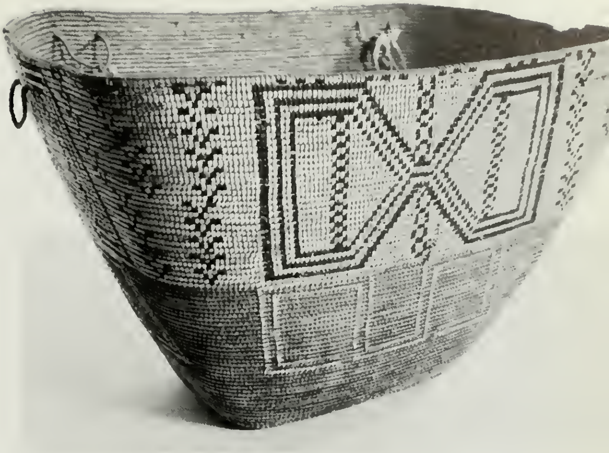
Coiled baskets, which are actually sewn rather than woven, were made only by Salish women. Coiled baskets in the northern Salish area are rectangular in cross section with right angle corners. (*see fig. D*). Southern Salish groups of the Puget Sound area made similar coiled baskets with an elliptical horizontal cross section. Each of these groups used distinct designs and placed them in characteristic ways. Designs were made by beading and imbrication. In beading, a colored strip of material is laid on the outside of the coil, and fastened into place with the sewing. In imbrication, a technique unique to the Salish, a decorative strand is lapped over and under each stitch. The result is a continuous series of rectangular blocks that completely cover the stitches.

Reasons for Diversity

The ultimate reasons for the extreme diversity of form, function, and technique of Northwest Coast basketry are multiple and complex. The prehistory of the Northwest Coast is only beginning to be studied in depth, and future work may reveal much more about the origins of the basketry.



C. Wrapped twining was used both for openwork, such as the Kwakiutl berry basket, #87822 (left), or for tightly woven work, such as the Chinook bag, #61958.



D. Coiled baskets were produced only by the Salish. Burden basket with imbrication in "butterfly" design, #103222.

The area of the greatest diversity of basketry manufacture is the region of Puget Sound and the Gulf of Georgia in the Salish area. Here, varieties of plaiting, coiling, and twining existed simultaneously. This area is also the area of greatest productivity of natural resources and has always been the area of greatest population density. The diversity of baskets may reflect the extreme richness of the area and the competition that occurred over these resources.

As in the case of the languages, some of the basketry techniques may have originated before a particular group of people migrated to the coast, as much as 10,000 years ago. Examples are the similar twined baskets of the Tlingit and the Haida, who speak closely related languages; and the coiled baskets of the Salish speakers, who are the only makers of coiled baskets in the area.

Certain specialized functions were best served by particular techniques. An example of this is openwork weaving. Since this technique holds the warp and weft fast at regularly spaced intervals, it is particularly well suited to fishtraps and for open baskets to wash clams and fish.

In some cases, the wide availability of a material such as red cedar (the material most used in plaiting) can go far to explain the widespread distribution of this technique in the area.

And finally, the demand for status items led to their dispersal and adoption. An example is the closely woven and painted spruce root hat, which was traded by the Tlingit and the Haida to the southern groups, and which eventually was copied by the Kwakiutl.

All these various factors together created a rich and fascinating assemblage of an ancient art. □

Rebirth of the Gamelan

Javanese orchestral ensemble resurrected after 80 years!

by Sue Carter-De Vale

In October, 1975, Dr. Ernst L. Heins of the University of Amsterdam, specialist in the music of West and Central Java, came to Northwestern University to be guest lecturer for a class in ethnomusicology I was teaching there.* He asked if I could arrange a viewing of some Sundanese gamelan instruments in storage at Field Museum and, a few days later, accompanied by Dr. Bennet Bronson, associate curator of Asian archaeology and ethnology, we had the extraordinary pleasure of seeing these 23 unique, 130-year-old instruments. As we left the Museum, Dr. Heins remarked that it was indeed a shame to have such a fine, complete gamelan laying idle in storage.

Several months later, in Amsterdam, I had my first performing experience on another gamelan—an experience that further inspired me to see what could be done to restore Field Museum's ensemble in its own home city. I began to have hope that others, in Chicago, might some day also have the special pleasure of gamelan performance. Home again, I discussed the matter with Field Museum Director E. Leland Webber, and within a month we had submitted a grant proposal to the National Endowment for the Arts.

Not long afterward, I had occasion to visit the Library of Congress, in Washington, D.C., where I learned that the library housed the oldest known gamelan recordings, and that these were of Field Museum's own ensemble performed at the 1893 Fair! Because the newly invented phonograph had only first been used in 1890 for the scientific collection and analysis of music, it would never have occurred to me to look for gamelan recordings made at an exposition scarcely three years later.

Again in Chicago, I received a letter from Dr. Heins, informing me that a Miss Norma Boreel, one of the gamelan players at The Hague's Gemeente Museum, was the granddaughter of the man who had conducted Field Museum's gamelan in 1893. When she learned of my own interest, she offered to lend her grandfather's photo album and other of his possessions relevant to the gamelan.

November 22, 1976, was truly a red letter day, for the Museum was then informed that it had been awarded the NEA grant for the restoration and eventual performance of the gamelan.

With Dr. Bronson as project director and myself as program and research director, our initial task was to

Bennet Bronson

Louis Pomerantz, gamelan conservator, works on base of saron, *one of several, single-octave metallophones in the gamelan ensemble.*

Sue Carter-De Vale's doctoral dissertation, "A Sundanese Gamelan: A Gestalt Approach to Organology," is based on largely on the gamelan in Field Museum's collection.

find a conservator who was an expert in the restoration of polychrome sculptures, for all the colorful, carved stands and resonators of the instruments were sadly in need of repair. For this important responsibility we were fortunate in finding the reknowned conservator, Louis Pomerantz, of Evanston. Dr. Heins was named external expert adviser. Dr. Walter McCrone, an analytical chemist, of Chicago, was secured to do extensive laboratory analysis of pigments, metals, wax, polishes, and fabrics used in the construction of the instruments. Mr. Pomerantz acquired a splendid crew of volunteers to serve as assistant conservators.

Our final hope was to secure funding to replace some of the string and wind instruments and the drums, now too fragile to be played, and to add certain instruments so that the gamelan could be played in the distinct musical styles of both Central and West Java. A generous grant from the Walter E. Heller Foundation made this possible.

On November 9 a selection of the gamelan instruments will be played in public for the first time in more than eight decades, and in January the entire ensemble will be played, just as it had been at the 1893 Fair. The November performance will be by visiting Sundanese Penca and Topeng Bakakan troupes. Director of the January performance will be Pak Hardja Susilo, Javanese dance and gamelan master at the University of Hawaii.

The Gamelan Project: A Conservator's Challenge

Louis Pomerantz

When asked if I would be interested in undertaking the task of restoring the gamelan, I was intrigued by the prospect on several counts. For one, my wife was born in West Java, where Field Museum's gamelan is believed to have been built, and in committing myself to this project I would become better acquainted with that island's culture, of which I had only a vague notion. Secondly, the technical challenges inherent in the conservation and restoration of the gamelan appealed to me.

These curious musical instruments are brilliantly painted, hand-carved, wooden sculptures, with subtle symbols hidden in their intricate designs. The materials they were made from include various woods, cloth strips, rope (horsehair?), iron nails, multiple layers of oil paint, gold leaf, mirror glass lined with slivers of lead, leather strips, parchment, and plant reeds. The poor state of preservation of the 130-year-old instruments was due to a gradual shrinkage of the wood over the years, and more recently to water damage. In many places the film of paint was like a glove that is now too large for the hand. There were splits and cracks in the wood; some of the instruments had been crudely fixed in the past, requiring structural repairs now; in some areas the paint had flaked off, elsewhere decorative mirror chips were missing; the shellac outer coating had turned a blackish-brown, concealing the brilliance of the original color beneath. The amount of conservation and restoration work that wa required seemed formidable indeed, and I would require help if the job were to be done in time.

Walter McCrone, analytical chemist, examines large gong.

As expected, the project—beginning last January—has attracted a number of talented volunteers, including some with a desire to become professional conservators. My senior volunteer is Helen Urban, a grandmother who flies to Chicago from her home in Des Moines, Iowa, every Monday, just to participate in the gamelan restoration. Lisa Kent, a Smith College sophomore, reluctantly returned to school in Massachusetts following a summer's work on the gamelan. A graduate of the School of the Art Institute of Chicago (SAIC), Christine Abiera, has just entered Washington University to prepare for a career in conservation following six months of volunteer work with us. A skilled needlepoint worker, Shawna Clark, spends her day off from a department store to work at the Museum, dividing her time between the gamelan and other volunteer projects. Judith Spicehandler is a talented painter of calligraphic subjects whose assistance is made possible by an SAIC work/study grant. Anna Campoli is an SAIC graduate with a special interest in etching. Elizabeth Peacock, a data-processing specialist with an interest in a conservation career, is our most recent volunteer.

As Sue De Vale would say, "The gamelan has been working its powers and has us in its grip." We all look forward to that day when it will be reborn and played again.

On Your Own At Field Museum

by Audrey Hiller

"With so much to see, where do we start?" This question confronts hundreds of family groups every year as they enter majestic but somewhat overwhelming Stanley Field Hall at Field Museum.

Family trips to the Field Museum can be fun or frantic—beneficial or boring. The temptation is there to try to cover as much of the ten acres of exhibits as possible in the time available.

What *can* a family do—with an hour to spend at the Field Museum, or two hours, or three or four? With the programs developed by the Museum's Department of Education, says Dr. Alice Carnes, the department's head, guidance and help for a profitable visit that is entertaining as well as educational are available to those who want them.

The *Place for Wonder*, *Museum Journeys*, *Uniguide* (the audio information system), *Weekend Discovery Programs*, printed *Self-Guided Tours*, and the new *Pawnee Earth Lodge* taped and live programs—all are possible embarkation points. Those starters—all in the form of printed materials—are available at the Museum at no charge or at a nominal cost.

Place for Wonder

A five-year-old girl is opening a drawer filled with animal coverings and carefully pulling out a wolf skin; her older brother, at the same time, is looking through a magnifier at a fish-shaped fossil. Father has taken a seashell from a cabinet and Mother is browsing among books on animals and fossils that she has selected from the all-levels book collection. This family group could be one who has discovered the new "hands-on" gallery on the Museum's ground floor. *Place for Wonder* is a good introduction for Museum-visiting for parents as well as children.

To handle, sort, compare, feel, and try on natural history specimens and artifacts is to get behind the Museum's barriers, to feel you are inside the glass cases. Trained volunteers are on hand to help. The area is open to children and parents on weekdays from 1 to 3 p.m. and on weekends from 10 a.m. to 3 p.m. Weekday mornings are reserved for school groups.

The gallery has a quotation at its entrance: "We hope you will find two things here: 1. That all life is full of variety; and 2. That you can make connections among the objects in this room, the Museum exhibits, and your own life."

At separate cabinet-tables for different scientific areas, children and their parents can handle an assortment of museum specimens. They might inspect a butterfly's wings with their own magnifier at one, or examine a hawk's claws at another. They could compare rocks and minerals in another area or try on the fabrics and jewelry of West Africa while listening to the rhythmical music of that land. All of these and other items are here with the idea that visitors can find their own answers by observing, classifying, and drawing conclusions about relationships.

"Whole families can share in these activities," said the Education Department's Carol Scholl. "Once the initial hesitancy is overcome, observation can lead to discovery and the beginning of an on-going learning experience." Carol is currently working on development of labeling in the gallery for the blind and visually handicapped.

A large selection of books on natural history subjects, from colorful picture books for preschool to high school level references, is scattered throughout, encouraging a shared activity of looking up, identifying, and reading for parents and children. A set of slides of birds of the Chicago area with their identification is one of many slide sets that can be viewed at a light table.

Carolyn Blackmon, one of the Education Department's staff responsible for development of the Place for Wonder, says the hall is so popular, more volunteers are needed to extend the hours when it is open to the public. Only 25 visitors can be accommodated at one time. Anyone wanting to be interviewed for this or other volunteer activity may call the Volunteer Office at the Museum (922-9410).

Museum Journeys

"Cook's Tour"—the fall Journey, leads visitors through some North American cultures with food on their minds. What is hominy? What do you do with buffalo meat to make it edible? A chart in the Journey booklet directs the museum journeyers to look at their own eating experiences and compare them with those of the Woodlands, Plains, and Pomo Indian. "What kinds of tools did they use to prepare food?" "How were the foods preserved?" Answers can be written or drawn in on the Journey booklets.

Museum Journeys are printed guides for self-conducted tours that lead to specific exhibits and explore an aspect of natural history. The summer Journey, for example, was on spelunking and took the visitor on a trip

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Audrey Hiller is a Department of Education volunteer.

through the world of caves, their biology and geology.

Journey booklets are designed with children in mind and are ideal as a family project. By posing questions, a Journey helps the young visitor to get more out of the exhibits. Each Journey has a theme that is cross-disciplinary; it may relate the main subject to the environment or people, plants, or animals and let visitors draw their own conclusions. Not all the answers are obvious; some are subjective and the questions require thinking, not just label-reading. The answers may be a drawing or an opinion. By discussing the questions with their children, parents can make the answers a family learning endeavor.

The current Journey booklet, available without charge at the information booth on the main floor, is a colorful souvenir to take home from a visit to the Museum. New Journeys are published four times a year, in September, December, March, and June.

In addition to the free current Journeys, other Journeys are available in the Museum Shop for a nominal fee. A choice of subjects allows those not interested in the current Journey's subject, or wanting to continue the Journey idea, to do so. Four are on sale now with more to follow. "Friend or Foe" deals with animals whose reputations are in question. "Tibet, Nomads of the Mystic Mountains" is about the Asian people of that remote area. "Chicago, My Kind of Town," is about the changes that have taken place in Chicago over millions of years, and "Artist's Zoo" gives everyone an artistic challenge.

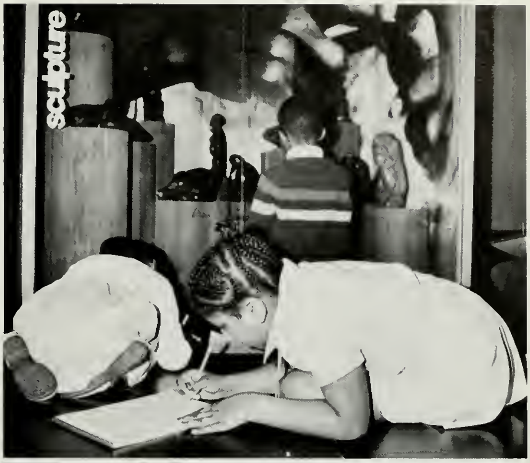
Uniguide

Did you know that lions are the only large cats who live together in family groups called prides? This is just one of many facts one can glean while listening to the Uniguide, the Museum's new audio information system, and looking at the relaxed African lion family scene of parents and playful cubs in Hall 31.

Or did you know that the fierce-looking Bushman, the Museum's famed gorilla, was once himself intimidated into returning to his Lincoln Park Zoo enclosure by a tiny snake? This proud specimen now has a prominent position in the Anniversary Exhibit in Hall 3 and is as lifelike as when he was a star attraction at the Zoo more than a quarter-century ago. On his glass case and on many others throughout the Museum is a sticker that tells visitors they can hear more about this exhibit on the Uniguide handset.

A Uniguide sticker shows that here a hidden transmitter sends out a coded audio signal via a beam of modulated, invisible light. The Uniguide phone captures the light, decodes it, and it is translated into voices, music, and sound effects.

These "Sounds and Stories of the Field Museum" are transmitted to hand-held phones which are available for a nominal fee at the entrance to the Museum Shop. Background music, sound effects, and factual information supplied by the Museum's staff will be wired into areas of the Museum that are broadly representative of themes and exhibits—from mummies to mastodons and moose to meteorites. A map is provided with the Uniguide receiver so that a family may choose the subjects of special interest to them as they take their self-conducted tour. At this writing, 35 areas are wired for sound, with a total of 50 expected to be ready by the time installation is completed.



Answers may be written or drawn in Museum Journey *booklets.*

"Write your own name in hieroglyphs" or "Try printing with an Adinkra stamp (a method used by West African people to make colorful fabrics)." These are just two of the do-it-yourself Weekend Discovery activity choices available to Museum visitors.

Stemming from the recognized need to better acquaint weekend visitors with the exhibits and to provide background on exhibit subjects, the Discovery programs came into existence two years ago under the direction of the Education Department's Julie Castrop. Vicki Grigelaitis coordinates the program, which varies from week to week with several program options available each Saturday and Sunday.

Volunteers supplement existing exhibits with "in-the-halls" action. The programs are conducted by individuals who have a background in a subject, or who wish to expand their own knowledge in an area, or who want to transmit their enthusiasm for a subject to others—but are working Monday to Friday at other jobs. On their days off on weekends, they give tours, conduct demonstrations, or provide participatory activities for Museum visitors.

Subjects ranging from "People of the Totem Poles" to "Early Man" and "Chinese Jades" are among the current "tours" available. These are discussion programs with artifacts or slides, using an exhibit as a focal point.

Visitors receive a short listing sheet of daily activities as they enter the Museum, and the current Weekend Discovery programs are listed there each Saturday and Sunday.

Self-Guided Tours

"What is the p'i-p'a? What does his calligraphy tell you about the man of China in the 1700s? What does a singing cricket in your home mean?"

These questions are answered in one of the Self-Guided Tour sheets now available at a nominal fee in the Museum Shop. The booklets lead the visitor into an in-depth experience in specific exhibit halls. While Museum Journeys are created with children in mind, the Self-Guided Tours are planned for adults or family groups of high school age and up.

"The material is more straightforward, not asking questions, but focusing on objects in an exhibit," says Julie Castrop, who coordinates preparation of the printed tour guide sheets. "They create a context for them not already obvious in the exhibit."

"China in the Ch'ing Dynasty" is a self-guided tour booklet which leads one to the Museum's Ch'ing Dynasty exhibit in Hall 32 and answers the questions above and many more.

Some tour booklet material is in the form of anthropological comments on an exhibit, as in "The Iroquois: Culture in Transition." "Animals in Egyptian Mythology" directs the visitor to zoology exhibits showing the real animals—scarab, cobra, mongoose—represented in the ancient Egyptian art and statues exhibit on the ground floor.

Some self-guided tour booklets include lists of recommended books for further study. More tour sheets are in preparation and will be available soon.

Pawnee Earth Lodge

On the sloping roof of the Pawnee earth lodge are five lifesize Pawnee figures, looking out over the Museum's limited horizons instead of the flat lands of Oklahoma. Inside the lodge, sitting on buffalo robe-covered beds, amidst the tools and crafts of the Pawnee, the visitor is transported in imagination to the mid-19th century in Pawnee, Oklahoma, as the people lived in that place and time—hearing, seeing, touching, smelling some elements of their lives. The new recreation of a Pawnee earth lodge of cottonwood, willow, mud, and thatch brings together authentic materials to let the visitor envision the people who lived there.

Volunteers who have had extensive training take groups through a brief lecture at the lodge's tunnellike entrance, introducing the Pawnee and their history. As the group enters the lodge and is seated on the buffalo robe-covered seats, they hear a taped program which changes with the changing seasons. The artifacts which the tape explains are handed to visitors for their inspection. Volunteers also act as resource people to answer questions. The total tour time at the lodge is 40 to 45 minutes, with schedules of starting times posted at the lodge entrance. The public is admitted on weekdays at 11:15 a.m. and 12:30 p.m., and on weekends at 10 and 11:15 a.m. and 12:30 and 1:45 p.m.

When regular programs are not scheduled, visitors may walk into the tunnel entrance to see the lodge interior and hear a seven-minute tape, activated by a push-button. A picture panel outside the lodge provides a story and comparison of the old days in Pawnee life in Nebraska and life as it is now lived by many Pawnee in Oklahoma.

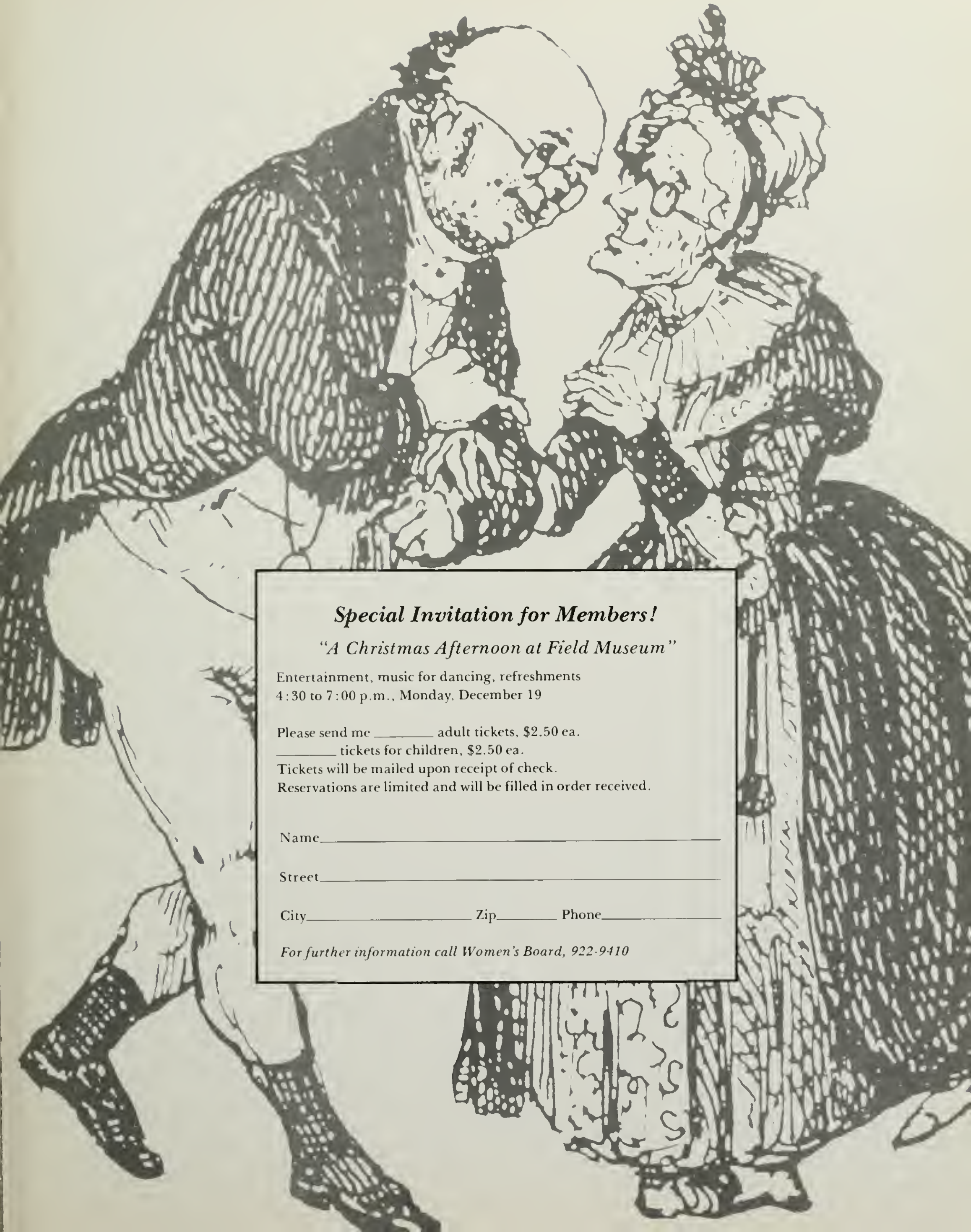
Other Educational Programs

Interested parents can call to the attention of their children's teachers the possibilities for help with visits to Field Museum. Requests for guided programs for school groups exceed the supply to such a degree that only twenty percent of school groups wanting educational tours can be accommodated. The Museum's professional instructional staff and trained volunteers take school groups through special areas of interest, but these are often booked up for specific dates as much as a year ahead. If a school group can be flexible in its choice of dates, an educational tour often can be arranged.

As an alternative, for tours on their own, help is available to teachers and leaders of community groups from the Museum's Harris Extension. The Harris materials prepare children for a visit and help teachers with follow-up ideas after the trip. Booklets and activity suggestions cover specific areas of the Museum, such as birds, Woodland Indians, and prairies. These materials are available without charge to teachers and leaders of community groups so they may conduct their own tours. Teachers and leaders may send inquiries to Harris Extension at the Museum.

Field Museum's other educational programs geared to adults and families include the Kroc environmental field trips, adult education courses, the Ayer film lecture series, weaving demonstrations with North Shore Weavers' Guild members explaining weaving and spinning on Monday, Wednesday, and Friday from 10 a.m. to noon, and exhibit-related special programs.

The Field Museum *Bulletin* lists on its back cover the current calendar of special and continuing events. Before leaving home for a Museum visit, members might refer to this listing to make the best use of their time at the Museum and check the latest "specials." □



Special Invitation for Members!

"A Christmas Afternoon at Field Museum"

Entertainment, music for dancing, refreshments
4:30 to 7:00 p.m., Monday, December 19

Please send me ________ adult tickets, $2.50 ea.
________ tickets for children, $2.50 ea.
Tickets will be mailed upon receipt of check.
Reservations are limited and will be filled in order received.

Name____

Street____

City____________________ Zip________ Phone______________

For further information call Women's Board, 922-9410

November and December at Field Museum

(November 15 through December 15)

New Exhibits

Pawnee Earth Lodge. Field Museum's newest permanent exhibit is a traditional Pawnee earth lodge—the home and ceremonial center of Pawnee Indians, as it existed in the mid-1800s. Daily programs, inside the 38-foot-diameter lodge, provide opportunities to learn about Pawnee culture. Check electronic monitors for specific times. Hall 5.

Contemporary Southern Plains Indian Metalwork. Exhibit of 110 examples of contemporary metalwork created by 15 Native American craftsmen from western Oklahoma. Hall 4. Through Jan. 15.

Iroquois Kitchen. This exhibit shows how traditional Native American ritual is preserved in a modern setting. Hall 5. Permanent.

Monkeys Inside and Out—opens November 15. Exhibit of monkey illustrations appearing in the recently published *Living New World Monkeys*, Vol. 1, by Philip Hershkovitz, emeritus curator of mammals. Hall 9. No closing date.

Exotic Flyers: Portraits of Neotropical Birds—moves to Hall 9, November 15. Exhibit of exquisite bird illustrations appearing in the recently published *Manual of Neotropical Birds*, Vol. 1, by Emmet R. Blake, emeritus curator of birds. No closing date.

New Program

Javanese Music and Dance Performance—November 9, at 8:00 p.m. The Performing Arts Program of the Asia Society will perform *Penca*, a dance from the Art of Self-Defense, and *Topeng Babakan*, a village mask dance with one dancer changing masks and assuming four or five roles. Both dances accompanied by the museum's newly renovated gamelan—Javanese orchestral ensemble. Simpson Theatre, ground floor west. Free tickets available at west door.

Continuing

Ayer Film/Lecture Series. Each Saturday, at 2:30 p.m., sit back and enjoy a 90-minute adventure in a remote or familiar area of the world. The films are personally narrated by their film makers. Reserved seating available for members and their families. Doors open at 1:45 p.m. Simpson Theatre, ground floor west.

Nov. 19	*The Alps to the Riviera* by William Sylvester
Nov. 26	*Yosemite and the High Sierra* by Bob Roney

The Ancient Art of Weaving. Weaving and spinning demonstrations every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

The Place for Wonder. This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m. Ground floor. Permanent.

Male and Female: Anthropology Game. The exhibit where visitors become anthropologists. Discover that economic and social roles of the sexes are not universally the same. Ground floor. No closing date.

Autumn Journey for Children: Cook's Tour. Self-guided tour leads children through museum exhibits to learn about food, cooking utensils, recipes, and food preparation of other cultures. Free *Journey* pamphlets available at information booth, main floor. Through Nov. 30.

On Your Own. Adult- and family-oriented self-guided tour booklets are available for 25c at entrance to the Museum Shop, main floor north.

Audio Information System, The museum's newly installed audio system, Uniguide, enables visitors of all ages to visit selected exhibits in any sequence they choose. Specially designed audio receivers and maps available for a nominal fee at entrance to the Museum Shop, main floor north.

Weekend Discovery Programs. Guided tours, demonstrations, and participatory museum-related activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

Special-Interest Meetings Open to the Public

Nov. 1,	7:30 p.m.	**Kennicott Club**
Nov. 3,	7:00 p.m.	**Primitive Arts Society**
Nov. 4,	8:00 p.m.	**Chicago Anthropological Society**
Nov. 6,	2:00 p.m.	**Chicago Shell Club**
Nov. 8,	7:30 p.m.	**Nature Camera Club**
Nov. 9,	7:30 p.m.	**Windy City Grotto, National Speleological Society**
Nov. 9,	7:30 p.m.	**Chicago Ornithological Society**
Nov. 10,	8:00 p.m.	**Chicago Mountaineering Club**
Nov. 15,	7:30 p.m.	**Chicago Audubon Society**
Nov. 27,	2:30 p.m.	**Illinois Audubon Society**

November and December Hours

The Museum opens daily at 9 a.m. and closes at 4 p.m. Monday through Thursday; 5 p.m. Saturdays and Sundays. On Fridays year-round, the museum is open to 9 p.m.

The Museum Library is open 9 a.m. to 4 p.m. Monday through Friday. Obtain pass at reception desk, main floor.

Museum telephone: 922-9410

December
1977

Field Museum of Natural History Bulletin

Field Museum
of Natural History
Bulletin

December, 1977
Vol. 48, No. 11

Editor/Designer: **David M. Walsten**
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CONTENTS

3 **Peru's Golden Treasures**
Exhibit on view at Field Museum February 16 to May 21

By Michael Moseley, associate curator, Middle and South American archaeology and ethnology

4 **Appointment Calendar for 1978**
Features photos of Peruvian treasures

back cover **December and January at Field Museum**
Calendar of coming events

Field Museum of Natural History
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President and Director: **E. Leland Webber**

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COVER

Pair of ceremonial gold hands and arms or gloves, with the fingers, thumbs, and nails carefully depicted (the latter with applied silver). The arms are decorated with longitudinal bands containing embossed wave pattern, birds, scales, and triangles. On the backs of the hands are depicted files of warriors, in profile, with domed and plumed headdresses, breastplates, and short skirts. The eye form is in the Lambayeque style. Chimu (900-1470 A.D.). Length: 53.9 cm and 54.6 cm, left and right, respectively. These hands, together with other treasures of ancient Peru, will be on view at Field Museum beginning February 16.

Peru's Golden Treasures has come to the United States under the auspices of the Government of Peru; its appearance in the United States has been organized by the American Museum of Natural History. The exhibit is supported by a federal indemnity from the Federal Council on the Arts and the Humanities. All items in the collection were assembled by Sr. Miguel Mujica Gallo of the Museo Oro del Peru.

The cover photo and all other photos in this issue are reproduced courtesy of the Royal Ontario Museum, Toronto.

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Peru's Golden Treasures

By Michael Moseley

From February 16 through May 21 Field Museum will host the largest collection of Peruvian gold artifacts ever shown in the United States; more than 200 beautifully wrought pieces, all pre-Columbian, will be on view in Hall 26.

Raiment of the ruling class, headdresses, funerary masks, jewelry, children's clothing, tools, eating utensils, and a variety of decorative objects—all are to be found in this remarkable assemblage. The pure "goldness" of many of the pieces is enough to bedazzle the modern viewer, but more important is the historic-aesthetic essence of the collection —remnants of a once-thriving, highly sophisticated civilization. Jewelry items were often wrought with as much symmetry and style as those created by today's master craftsmen, and even the most utilitarian objects were rendered with a special aesthetic sense or even whimsy.

Assembled from the magnificent collection of the Museo Oro del Peru, in Lima, the exhibit displays the arts of five cultures: Inca (1300-1532 A.D.), Chimu (900-1470 A.D.), Moche (200-700 A.D.), Nazca (200-5 A.D.), and Vicus (200 B.C.-300 A.D.). The objects that have been preserved from these ancient cultures represent but the smallest fraction of those amassed by the Incas in their mountaintop capital of Cuzco, in what is today south-central Peru.

Upon first entering the city in 1533, the Spanish conquistadores were awe-struck by the opulent splendor. But the golden gardens and palaces which they immediately beheld were a fraction of Cuzco's treasures. In a vain attempt to ransom his freedom, the Inca ruler Atajualpa gave his Castilian conquerors "a roomful of gold and two rooms full of silver," worth more than $50 million by today's standards. Yet, like the conquistador who gambled away his share of the vast fortune in a single night, all these objects of metalsmiths' art were lost—lost to Spanish smelters and formless bullion.

Most surviving examples of native goldwork come from buried graves looted long after the conquest of Peru. These rare and beautiful objects reflect an ancient metalsmithing tradition that began millenia before its Inca culmination. The symbolism and social roles played by precious metals among the earliest cultures remain elusive, because the jewelry and art works are from plundered tombs, not archaeological excavations. Yet, as the exhibit makes clear, the elite among these ancient peoples went to their graves richly bedecked with golden crowns, necklaces, gloves, and boots; their mummified bodies were wrapped in fine cloth and they wore ornate gold face masks.

Among the Inca the importance of precious metals is better known. Conquistadores estimated that the lords of Cuzco collected annually six million ounces of gold and twenty million of silver from their vast empire. Gold was symbolic of the sun, and silver of the moon. Only individuals of royal blood —the "children of the sun"—could legitimately possess objects fashioned from gold. To ensure this royal monopoly, the law stipulated that all gold brought into Cuzco could never again leave the sacred city. Precious metals found many uses in addition to decorating palace buildings and ornamental gardens. As a sun symbol, gold was an adornment of the elite and even worked into their clothing and robes.

The hammered discs or small cast ornaments were sewn to shirts and capes; gold, often inlaid with shell or semiprecious stone, was used for ear and nose ornaments. Many golden objects were covered with paint, so that the gold was not visible. Thus, the property of being intrinsically of gold was at least as important as the object's appearance.

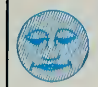
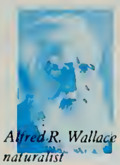
Many metalsmiths serving the lords of Cuzco came from foreign provinces, particularly along the Pacific desert. About A.D. 1470, the Inca incorporated the Chimu, a large and wealthy coastal empire with many skilled craftsmen. This conquest not only enriched the Inca's coffers, but brought to Cuzco Chimu metalsmiths, who excelled in working gold and silver for their new masters.

The history of Ancient Peruvian gold is a long and varied tradition which lasted three millenia. The new exhibit presents a glittering reflection of this history, and a tantalizing glimpse of the wonders greeting Francisco Pizarro and his band of Spanish adventures when they landed in Peru more than 400 years ago. ☐

Michael Moseley is associate curator, Middle and South American archaeology and ethnology.

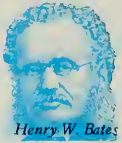
January 1978

Field Museum of Natural History

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1 New Year's Day Museum closed Jupiter brightest	2 last quarter	3 *Register now for winter adult education courses*	4	5	6	7 *2:00 p.m. lecture: "The Gamelan in Dance and Drama"*
8  new moon  *Alfred R. Wallace* *naturalist* *born 1823*	9	10	11 Mars brightest Jan 11-31	12	13	14 *Gamelan opening performance and Members' dinner 6:30 p.m.* *2:00 p.m. lecture: "Music for the Javanese Theatre"*
15 Martin Luther King Day first quarter	16	17 *Winter adult education courses begin*	18 *Winter adult education courses begin*	19 *Winter adult education courses begin*	20	21
22	23	24 full moon	25	26 *Volunteer training for "Peru's Golden Treasures"*	27	28 *Volunteer training for "Peru's Golden Treasures"*
29	30	31 last quarter	*Check your monthly Bulletin for special events*		DECEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	FEBRUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

February 1978

Field Museum of Natural History

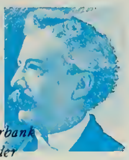
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JANUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	MARCH S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		1 *Spring Journey*	2 Ground-hog Day *Volunteer training for "Peru's Golden Treasures"*	3	4 *Volunteer training for "Peru's Golden Treasures"*
5 Saturn brightest Feb. 5-25	6	7 Shrove Tuesday new moon	8  *Henry W. Bates* *naturalist* *born 1825* Ash Wednesday	9 TO WASH 15 sec *Volunteer training for "Peru's Golden Treasures"* *Charles Darwin* *biologist* *born 1809*	10	11 *Volunteer training for "Peru's Golden Treasures"*
12 [illegible] Lincoln's Birthday	13	14 first quarter	15 *Members' Preview of "Peru's Golden Treasures"*	16 *"Peru's Golden Treasures" opens to public*	17	18
19	20 Presidents' Day*	21	22 Washington's Birthday* full moon	23	24	25
26	27	28	**The observance of George Washington's birthday as a legal holiday on Feb. 22 began in 1796. In many states, however, his birthday is now celebrated on the 3rd Monday of February, designated Presidents' Day.*			*Check your monthly Bulletin for special events*

shape. Lambayeque style. Height 23 cm; width 23.2 cm.

Crest bordered with gold. Suspended "drops" of gold. Height 23 cm.

March 1978

Field Museum of Natural History



SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
FEBRUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	**APRIL** S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23/30 24 25 26 27 28 29		1	2 last quarter	3 *"Peru's Golden Treasures" lecture series begins*	4 Mercury brightest one hour after sunset *Ayer Lecture: Kenneth Richter's "Yosemite and High Sierras," 2:30 p.m.*
5	6	7 *Luther Burbank plant breeder born 1849*	8 new moon	9	10	11 *Ayer Lecture: Jens Bjerre's "India," 2:30 p.m.*
12	13	14	15	16 first quarter	17 St. Patrick's Day	18 *Ayer Lecture: Fred Bellinger's "The Mediterranean," 2:30 p.m.*
19 Palm Sunday	20 spring begins	21 Fra[illegible] [illegible] M[illegible]	22	23	24 Good Friday full moon lunar eclipse total in Alaska	25 *Ayer Lecture: Ken Wolfgang's "Japan," 2:30 p.m.*
26 Easter	27	28	29	30	31 last quarter	*Check your monthly Bulletin for special events*

16 cm. Bottom: *Parrot-shaped gold Chimu vessel. Wings and tail of separate sheets. Height 8.5 cm.*

April 1978

Field Museum of Natural History

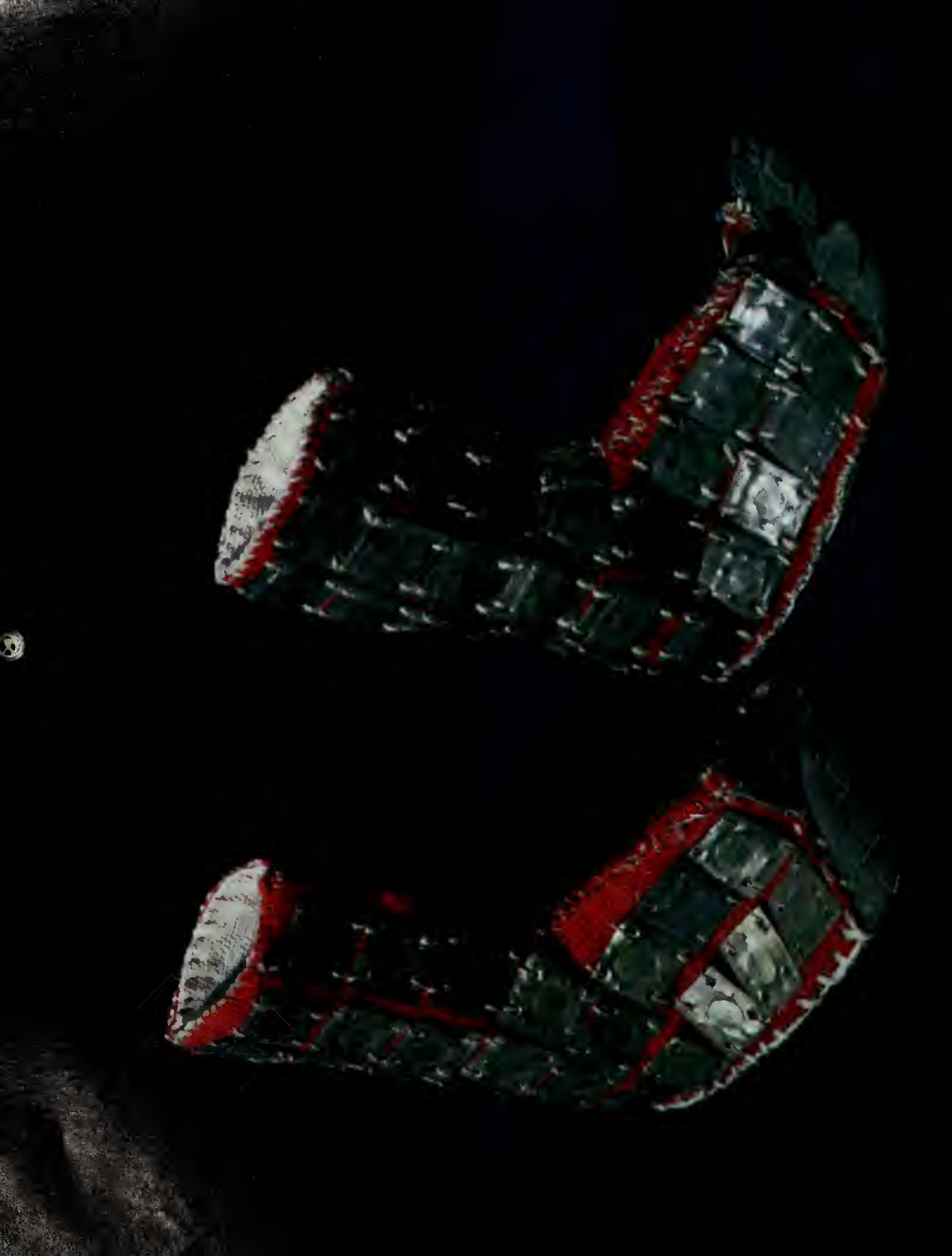
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
MARCH S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	MAY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		*Register now for spring adult education courses*			1 *Ayer Lecture: Chris Borden's "Iran," 2:30 p.m.*
2	3	4	5	6	7 new moon solar eclipse invisible in N. America	8 *Ayer Lecture: Captain Irving Johnson's "Sailing Adventures," 2:30 p.m.*
9	10	11	12	13 *Register now for Spring environmental field trips*	14	15 first quarter *Ayer Lecture: Curtis Nagle's "Portraits of Brazil." 2:30 p.m.*
16	17	18 *Spring adult education courses begin*	19 *Spring adult education courses begin*	20 *Spring adult education courses begin*	21	22 Passover full moon *Ayer Lecture: Quentin Keynes' "To Spot a Zebra," 2:30 p.m.*
23 / 30	24	25	26 *John J. Audubon artist-naturalist born 1785*	27	28	29 last quarter *Ayer Lecture: Howard Myers' "Mexico—Legend of a Lost Crown," 2:30 p.m.*

Silver funerary mask, believed to be Vicus. Gold ear ornaments inlaid with turquoise bearing representations of squirrels. Height 18 cm; width 28.5 cm.

May 1978

Field Museum of Natural History

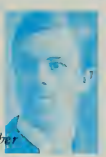
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1	2 *Field Museum opens Grant Park building 1921*	3	4	5	6 *Spring environmental field trips begin* new moon
7 *Spring environmental field trips begin*	8	9	10	11	12	13
14 **Mother's Day** *Check your monthly Bulletin for information on Children's Programs*	← Members' Nights → 15 first quarter	16 [illegible]	17	18	19	20
21	22 full moon	23 *Carolus Linnaeus naturalist born 1707*	24	25	26	27 *Rachel Carson environmentalist born 1907*
28 last quarter *Louis Agassiz naturalist, geologist born 1807*	29 **Memorial Day**	30	31		APRIL S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23/30 24 25 26 27 28 29	JUNE S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



Child's boots, Chancay. Made of L-shaped tapestry-woven material, lined with cotton. Square plates and roundels of gold. Length 15.5 cm, height 12.5 cm, width [illegible] cm.

June 1978

Field Museum of Natural History

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
MAY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	JULY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23/30 24/31 25 26 27 28 29			1 *Summer Journey*	2 *"Field Columbian Museum" opens in Jackson Park 1894*	3
4	5 new moon	6	7	8	9	10
11  *Alfred L. Kroeber anthropologist born 1876*	12	13 first quarter	14 **Flag Day**	15	16	17
18 **Father's Day**	19	20 full moon	21 summer begins	22	23	24
25	26	27 last quarter	28	29	30	*Check your monthly Bulletin for special events*

Nazca cup or helmet made of reeds, sewn together with cord and covered with gold foil. Height 19 cm, diam. 28 cm.

July 1978

Field Museum of Natural History

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JUNE S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	AUGUST S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31				*Check your monthly Bulletin for special events*	1
2	3	4 Independence Day	5 *Highlight Tours 2:00 p.m.* new moon	6 *Highlight Tours 2:00 p.m.*	7 *Highlight Tours 2:00 p.m.*	8 *Franz Boaz anthropologist born 1858*
9	10	11 *Highlight Tours 2:00 p.m.*	12 *Highlight Tours 2 p.m.*	13 *Highlight Tours 2 p.m.* first quarter	14 *Highlight Tours 2 p.m.*	15 *Special film program 2:00 p.m.*
16	17	18 *Highlight Tours 2 p.m.*	19 *Highlight Tours 2 p.m.* full moon	20 *Highlight Tours 2 p.m.*	21 *Highlight Tours 2:00 p.m.*	22 *Gregor Mendel geneticist born 1822*
23 / 30	24 / 31	25 *Highlight Tours 2:00 p.m.*	26 *Highlight Tours 2:00 p.m.* last quarter	27 *Highlight Tours 2:00 p.m.*	28 *Highlight Tours 2:00 p.m.*	29

Gold Chimu crown. Broad central band has pairs of zoomorphic figures. Height 19.5 cm., diam. 19 cm.

August 1978

Field Museum of Natural History

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JULY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23/30 24/31 25 26 27 28 29	SEPTEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1 *Jean-Baptiste de Monet Lamarck* *biologist* *born 1744*	2 *Highlight Tours 2:00 p.m.* 3^{30} Singer Carolyn	3 *Highlight Tours 2:00 p.m.* new moon	4 *Highlight Tours 2:00 p.m.*	5
6	7 *Louis S. B. Leakey* *anthropologist* *born 1903*	8 *Highlight Tours 2:00 p.m.*	9 *Highlight Tours 2:00 p.m.*	10 *Highlight Tours 2:00 p.m*	11 *Highlight Tours 2:00 p.m.* first quarter	12
13	14 *Register now for Fall Environmental Field Trips*	15 *Highlight Tours 2:00 p.m.*	16 *Highlight Tours 2:00 p.m.*	17 *Highlight Tours 2:00 p.m.*	18 *Highlight Tours 2:00 p.m.* full moon	19 *Traveler's Day: Final Journey Awards*
20	21	22 *Highlight Tours 2:00 p.m.*	23 *Highlight Tours 2 p.m.*	24 *Highlight Tours 2:00 p.m.*	25 *Highlight Tours 2 p.m.* last quarter	26
27	28	29 *Highlight Tours 2:00 p.m.*	30 *Highlight Tours 2:00 p.m.*	31 *Highlight Tours 2:00 p.m.*		

September 1978

Field Museum of Natural History

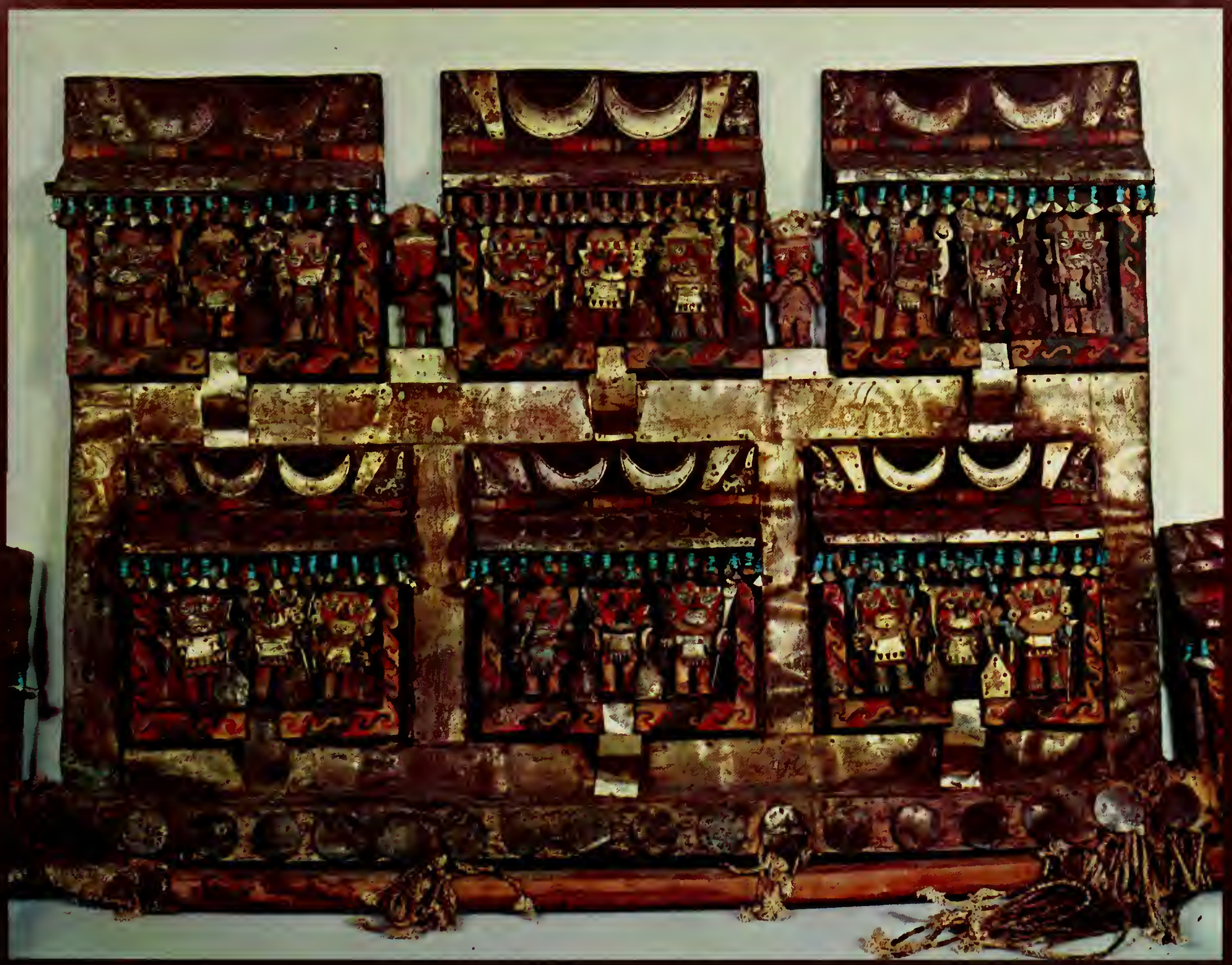
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
AUGUST S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	OCTOBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			Mus 12 – 7 10 *Check your monthly Bulletin for special events*	1 *Fall Journey* Mus 12 – 6	2 new moon
3	4 **Labor Day** Mercury brightest 1 hr. before sunrise	5	6 Mus 12 – 5 10 1 hr NSF about Mus	7	8	9 *Fall environmental field trips begin* first quarter
10 *Fall environmental field trips begin*	11	12	13	14	15	16 *Field Museum founded 1893* full moon lunar eclipse invisible in N. America
17	18	19	20 *Register now for fall adult education courses*	21	22 NSF SST PROP. due	23 fall begins
24 last quarter	25 *Thomas H. Morgan geneticist born 1866*	26	27	28	29	30

headdresses inlaid with turquoise. Larger pendant is of human-headed bird with turquoise. Length 71 cm.

October 1978

Field Museum of Natural History

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2 Rosh Hashana new moon solar eclipse invisible in N. America	3 Venus brightest	4	5	6	7 *Ayer Lecture: Willis Butler's "Turkey" 2:30 p.m.*
8 FMUS FieldTrip Ryerson Conserv. Area	9 Columbus Day first quarter	10 *Fall adult education courses begin*	11 Yom Kippur *Fall adult education courses begin*	12 Columbus Day (Traditional) *Fall adult education courses begin*	13	14 Valentines Day *Ayer Lecture 2:30 p.m.*
15	16 full moon	17	18	19	20	21 *Ayer Lecture 2:30 p.m.*
22	23 last quarter	24 *Anton van Leeuwenhoek microscopist born 1632*	25	26 715p | Auditorium	27	28 *Ayer Lecture 2:30 p.m.*
29	30	31 Halloween new moon		*Check your monthly Bulletin for special events*	SEPTEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	NOVEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



decoration. Such treatment indicates that gold was not intrinsically as valuable to ancient Peruvians as to us. Height 58 cm; width 113.5 cm.

November 1978

Field Museum of Natural History

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	Check your monthly Bulletin for special events	*Do your Christmas shopping now at Field Museum Shops*	1	2	3	4 *Ayer Lecture 2:30 p.m.*
5	6	7 Election Day first quarter	8	9	10	11 Veterans' Day *Ayer Lecture 2:30 p.m.*
12	13	14 full moon	15	16	17	18 *Ayer Lecture 2:30 p.m.*
19	20	21	22 last quarter	23 Thanksgiving	24	25 *Ayer Lecture 2:30 p.m.*
26	27	28	29	30 new moon	OCTOBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	DECEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24/31 25 26 27 28 29 30

Gold Ficus mask with heavy copper corrosion. Eyes of inlaid white shell, with pupils of pink shell inlay. Height 14 cm; width 10 cm.

December 1978

Field Museum of Natural History

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
NOVEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	**JANUARY** S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			*Check your monthly Bulletin for special events*	1 *Winter Journey*	2 *Archival Film Premier: 1940 Galapagos Expedition narrated by an expedition member, 1:30 p.m.*
3 *Archival Film Premier: 1940 Galapagos Expedition narrated by an expedition member, 1:30 p.m.* Illinois entered Union 1818 First Day in Advent	4	5	6 first quarter	7	8	9
10	11	12	13	14 full moon Venus brightest	15	16
17	18	19	20	21 winter begins	22 last quarter	23
24/31	25 Christmas Chanukah Museum closed	26	27	28	29 new moon	30

December & January at Field Museum

New Exhibits

Pawnee Earth Lodge. Field Museum's newest permanent exhibit, in Hall 5, is a traditional Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide opportunities to learn about Pawnee culture. Public programs: Monday through Friday, 12:30 p.m.; weekends at 11:15 a.m., and 12:30 p.m. Meet at the North Information booth. Programs are limited to 30 people.

Contemporary Southern Plains Indian Metalwork. Exhibit of 110 examples of contemporary metalwork created by 15 Native American craftsmen from western Oklahoma. Hall 4. Through January 15.

Iroquois Kitchen. This exhibit shows a traditional Native American ritual preserved in a modern setting. Hall 5. Permanent.

Monkeys Inside and Out. Exhibit of monkey illustrations appearing in the recently published *Living New World Monkeys*, Vol. 1, by Philip Hershkovitz, emeritus curator of mammals. Hall 9. No closing date.

Exotic Flyers: Portraits of Neotropical Birds. Exhibit of exquisite bird illustrations appearing in the recently published *Manual of Neotropical Birds*, Vol. 1, by Emmet R. Blake, emeritus curator of birds. Hall 9. No closing date.

Exhibit of Native American Basketry opens December 15. A rich and varied art form, expressed in utilitarian objects: cradles, fish traps, mats, hats, even drinking cups. Made by Indians of the Northwest Coast mostly around 1900. Hall 27. No closing date.

New Programs

Javanese Gamelan. Field Museum's gamelan, an ensemble of 23 fine bronze and wood musical instruments, has been restored for exhibition and performance. It is the oldest and perhaps finest gamelan outside Indonesia and has not been played since the World's Columbian Exposition of 1893. Several events are planned for coming weeks and months to introduce and demonstrate this extraordinary collection. For additional details consult January 1978 *Bulletin*.

January 7 lecture: "*The Gamelan in Dance and Drama*," by Hardya Susilo, gamelan master, University of Hawaii; 2:00 p.m., Simpson Theatre.

January 14 lecture: "*Music for the Javanese Theatre*," by Sue Carter-De Vale, gamelan program and research director; 2:00 p.m., Simpson Theatre.

Lecture series tickets: $3.00 for members, $5.00 for nonmembers. Remaining single tickets, if still available, will be sold on the day of the lecture: $1.50 for members, $2.50 for nonmembers.

January 14: Members' dinner (6:30 p.m.), featuring Javanese cuisine, with gamelan performance (8:00 p.m.), $10.00 per person. Tickets for gamelan concert only; $2.50 for members, $5.00 for nonmembers. For all tickets, send check to "Gamelan," Field Museum, including self-addressed, stamped envelope.

The Place for Wonder. This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1:00 p.m. to 3:00 p.m.; weekends, 10:00 a.m. to noon and 1:00 p.m. to 3:00 p.m.

Winter Journey for Children: "Hidden Faces." Self-guided tour leads children through Museum exhibits to learn about masks and their uses in different cultures. Free *Journey* pamphlets available at Information Booth, main floor. Through January 31.

Continuing

"On Your Own": *Self-guided tour booklets*, adult- and family-oriented, are available for 25¢ at entrance to the Museum Shop, main floor north.

Audio Information System. The museum's newly installed audio system, *Uniguide*, enables visitors of all ages to visit selected exhibits in any sequence. Audio receivers and maps available for $1.25 per person, $3.75 for a family of up to 5 at the entrance to the Museum Shop, main floor north.

Weekend Discovery Programs. Guided tours, demonstrations, and participatory museum-related activities. Every Saturday and Sunday, 10:00 a.m. to 3:00 p.m. except for Christmas and New Year's weekends.

Special Interest Meetings Open to the Public

Dec. 20, 7:30 p.m.	**Chicago Audubon Society**
Jan. 3, 7:30 p.m.	**Kennicott Club**
Jan. 5, 7:00 p.m.	**Primitive Arts Society**
Jan. 6, 8:00 p.m.	**Chicago Anthropological Society**
Jan. 8, 2:00 p.m.	**Chicago Shell Club**
Jan. 10, 7:30 p.m.	**Nature Camera Club**
Jan. 11, 7:30 p.m.	**Windy City Grotto**
Jan. 12, 8:00 p.m.	**Chicago Mountaineering Society**

December and January Hours

The Museum Opens daily at 9 a.m. and closes at 4 p.m. Monday through Thursday; Saturdays and Sundays, 5 p.m. On Fridays the museum is open to 9 p.m. Museum closed on Christmas and New Year's.

The Museum Library is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor.

Museum telephone: 922-9410.